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NATIONAL DAM INSPECTION PROGRAM. SUYDAM DAM, NDS ID PA 00085, D--ETC(U)
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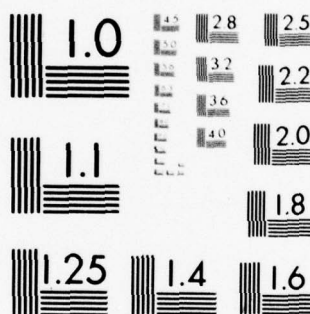
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Suydam Dam, NDS ID PA 00085, DER ID 64-169
Delaware River Basin, Lollipop Creek,
Wayne County, Pennsylvania. Phase I
Inspection Report.

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DELAWARE RIVER BASIN

SUYDAM DAM
WAYNE COUNTY, PENNSYLVANIA

NDS. I.D. NO. PA 00085
DER I.D. NO. 64-169

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



Prepared by:

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Submitted to:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

DECEMBER 1978

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D. C., 20314. The purpose of a Phase I investigation is to expeditiously identify those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify the need for more detailed studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected, and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Suydam Dam
County Located:	Wayne County
State Located:	Pennsylvania
Stream:	Lollipop Creek
Coordinates:	Latitude 41° 32.2' Longitude 75° 11.2'
Date of Inspection:	24 October 1978

Suydam Dam is owned by the Wayne County Commissioners and maintained by the County. The dam and reservoir are used as a flood control structure for the downstream town of White Mills, Pennsylvania. The impoundment was designed by the United States Department of Agriculture, Soil Conservation Service in 1958, and the structure was officially completed in 1960.

The dam and its appurtenant facilities are considered to be in good condition and well maintained. The dam is classified as a "Small" size structure with a "High" hazard classification consistent with its potential in the event of failure for extensive property damage and possible loss of life in White Mills, Pennsylvania.

Calculations indicate that the existing spillway systems are capable of passing the Probable Maximum Flood without overtopping. Therefore, the spillway system is considered to be "Adequate".

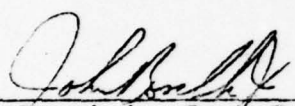
The visual inspection and review of the available documentation indicates that the dam, foundation and its appurtenant structures are in good condition, and that the embankment materials were placed in accordance with specification requirements. However, some minor scouring was noted at the plunge pool area of the principal spillway. This condition is considered to be undesirable.

Considering the condition of the dam, the following recommendations are presented:

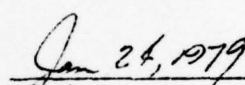
1. The plunge pool should be checked after each severe storm for scour and for possible undermining of the spillway bent. Should excessive scour occur, the plunge pool should be rehabilitated.

2. An alternate means of gaining access to the dam during periods of flow through the emergency spillway should be established. Presently, the only access is from the west across a shallow valley north of an existing farm pond and then across the emergency spillway. During severe storms it is judged that the dam would not be accessible by this route.

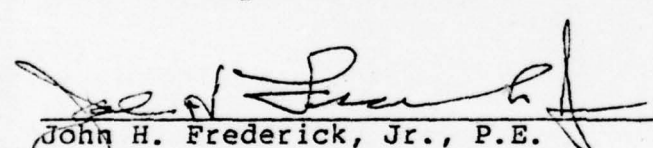
Because of the location of the dam upstream of White Mills, Pennsylvania, a formal procedure of observation and warning during periods of high precipitation should be developed and implemented. This procedure should include a method of warning downstream residents and industries of the possibility of flooding. The Owner should also develop an operation and maintenance procedure to be used to insure that the dam is operated in a safe manner and maintained in the best condition possible.



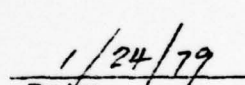
John Boschuk, Jr., P.E.
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Date

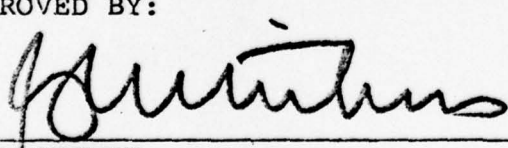


John H. Frederick, Jr., P.E.
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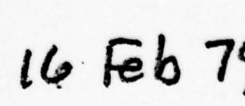


Date

APPROVED BY:



G. K. WITHERS
Colonel, Corps of Engineers
District Engineer



Date



OVERVIEW
SUYDAM DAM, WAYNE COUNTY, PENNSYLVANIA

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
SUYDAM DAM
NATIONAL ID #PA 00085
DER #64-169

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Suydam Dam is a 24 foot high homogeneous earth embankment, 508 feet long and impounds a 12.1-acre reservoir. The embankment contains a downstream crushed rock trench drain discharging through a 6-inch diameter corrugated metal drain. This pipe discharges at the downstream toe, ~~as shown by Plate 4.~~ The upstream slope to elevation 1,285.0 is protected with a 12-inch riprap layer over a 12-inch filter course, ~~as shown by Plate 3.~~

CADT → The upstream and downstream slopes are 3H:1V and 2H:1V, respectively. Except for riprapped surfaces, both slopes are covered with grass and Crownvetch. The crest is 12 feet wide with a settled design elevation of 1,298.0. ASPECT

Water is normally discharged through the principal spillway. A drop inlet riser is located at the upstream toe of the embankment at approximately Station 3 + 89, as shown on Plate 4. Water enters the low stage orifice at elevation 1,282.5 and overflows the riser weir at elevation 1,285.0 and discharges through a 24-inch diameter reinforced concrete pipe. The pipe discharges at the downstream toe and has an invert elevation of 1,272.0. The riser also contains a pond drain gate valve at elevation 1,276 which discharges through the 24-inch reinforced concrete pipe. The sluice gate is 12 inches in diameter and is manufactured by the Armco Manufacturing Company. The concrete discharge pipe is located at the base of the dam and is founded on natural ground. It is approximately 132 feet long and has 3 anti-seepage collars.

During severe storms, excess water can be discharged over the emergency spillway at the right abutment. The grass-lined emergency spillway is approximately 60 feet wide with a 20-foot long level control section at elevation 1,293. The channel discharges into the downstream valley meeting the principal spillway discharge channel approximately 300 feet downstream of the plunge pool.

b. Location. The dam is located on Lollipop Creek in Berlin Township, Wayne County, Pennsylvania. The dam site is approximately one mile northeast of White Mills, Pennsylvania, on a tributary of Lackawaxen River within the Delaware River Basin. The dam site and reservoir are shown on USGS Quadrangle entitled "White Mills, Pennsylvania", at coordinates N 41° 32.2' W 75° 11.2'. A regional location plan of Suydam Dam and reservoir is enclosed as Plate 1, Appendix E.

c. Size Classification. The dam is classified as "Small" by virtue of its 24-foot maximum height and 443 acre-foot maximum storage capacity.

d. Hazard Classification. A "High" hazard classification is assigned consistent with the potential for extensive property damage and loss of life in White Mills, Pennsylvania, downstream of the dam.

e. Ownership. Suydam Dam is owned by the Wayne County Commissioners and maintained by the County. All correspondence should be sent to Mr. Richard Simpson, Wayne County Commissioners, Court House, Court Street, Honesdale, Pennsylvania 18431.

f. Purpose of Dam. The purpose of the dam is for flood control. In 1962, the State built the retention pond and discharge channel in White Mills to further protect the town from flood damage. See Photos 11 and 12.

g. Design and Construction History. The dam was designed by the United States Department of Agriculture, Soil Conservation Service in 1958, for the purpose of flood control to protect the downstream town of White Mills, Pennsylvania. The application to construct Suydam Dam on the property of Frederick D. Suydam was submitted on 6 March 1959, and the "Report Upon the Application of Frederick D. Suydam" was issued by the State of Pennsylvania on 6 March 1959, by Mr. Joseph J. Ellam, Hydraulic Engineer for the Department of Environmental Resources. The permit to construct the dam was issued on 8 April 1959. Records indicate that construction by the E. P. Sodem Construction Company began in 1959 and the dam was completed by 1960. The dam was essentially completed by 25 September 1959 with the exception of some cleaning and grubbing and seeding of the slopes. All of the work was officially completed by 17

November 1960. The final inspection of the embankment was performed on 19 July 1961, and was found to be in excellent condition and constructed in accordance with the approved plans.

h. Normal Operating Procedures. Reservoir outflow is controlled by the principal and emergency spillways. Under normal conditions, water flows over the intake riser weirs, and/or through the low stage orifice, through a 24-inch diameter reinforced concrete pipe located at the base of the embankment, and discharges into a plunge pool at the downstream toe. The outlet invert of the pipe is at elevation 1,272.0. There are no minimum discharge requirements for this structure.

Excess water is stored up to elevation 1,293. Thereafter, water is discharged through the emergency spillway located at the right abutment.

The reservoir can be lowered or drained by opening the 12-inch sluice gate from the top of the riser to allow water to discharge into the 24-inch concrete pipe.

1.3 Pertinent Data.

A summary of pertinent data for Suydam Dam is presented as follows.

a.	Drainage Area (sq. miles)	0.74
b.	Discharge at Dam Site (cfs)	
	Max. Known Flood at Site	Unknown
	At Emerg. Spillway Crest	60
	At Design High Water	895
	At Top of Dam	1,800

c.	Elevation (feet above MSL)	
	Top of Dam	1,298.0
	Design High Water	1,296.2
	Emergency Spillway Crest	1,293.0
	Principal Spillway	
	Weir Crest	1,285.0
	Low Stage Invert (normal pool)	1,282.5
	Pond Drain Invert	1,276.5
	Outlet Invert	1,272.0
d.	Reservoir (miles)	
	Length at Normal Pool	0.46
	Fetch at Normal Pool	0.46
e.	Storage (acre-feet)	
	Sediment Pool	11
	Normal Pool	33
	To Emergency Spillway Crest	219
	To Top of Dam	433
f.	Reservoir Surface (acres)	
	Sediment Pool	5.8
	Normal Pool	12.1
g.	Dam Data	
	Type	Homogeneous earth fill
	Volume	20,000 cubic yards
	Length	508 ft
	Maximum Height	24 ft
	Top Width	12 ft design (13 ft measured)
	Side Slope	
	Upstream	3H:1V
	Downstream	2H:1V

Cutoff	Trench
Grout Curtain	None
h. Principal Spillway	
Type	2 ft x 6 ft x 11.75 ft concrete drop inlet riser discharging into a 24-in concrete pipe and plunge pool.
Elevations	
Weir	1,285.0
Low Stage Invert	1,282.5
Pond Drain Invert	1,276.5
Pipe Outlet Invert	1,272.0
Downstream Channel	1,270.0
i. Emergency Spillway	
Type	Trapezoidal channel cut through natural soils, grass lined.
Size	60 ft wide
Side Slopes	2H:1V
Downstream Channel	The channel meanders through a wooded flood plain before entering Butcher's Pond (also known as Trout Lake) 2,500 ft downstream of Suydam Dam.

SECTION 2

ENGINEERING DATA

2.1 Design.

a. Data Available. A summary of engineering data for Suydam Dam is presented in the checklist attached as Appendix A. Principal documents containing pertinent data used for this report are as follows:

1. "Report Upon the Application of Frederick D. Suydam" by Joseph J. Ellam, Hydraulic Engineer, Department of Environmental Resources (DER), dated 6 March 1959.
2. "Permit" prepared by the Commonwealth of Pennsylvania, Department of Environmental Resources, dated 8 April 1959.
3. An 11-sheet set of drawings prepared by U.S. Department of Agriculture, Soil Conservation Service (SCS), Job #PA-418-P, dated 1958.
4. Miscellaneous letters, correspondence, memos, including construction progress reports located in DER files in Harrisburg, Pennsylvania.

The available data was sufficient to evaluate the principal features of the dam and appurtenant structures. Selected portions of the SCS drawings are included in Appendix E of this report.

b. Design Features. The principal design features are illustrated on the plan, profile and cross-section plates of the

embankment and appurtenant structures that are enclosed in Appendix E as Plates 2 through 7. These plates are reproduced from the design drawings prepared by the SCS. A brief description of the design features is presented in Section 1.2, "Description of Project", and elaborated upon as follows.

The earth embankment consists of selected impervious material classified as clayey sands, which were reportedly compacted in layers 6 inches or less to densities exceeding at least 95 percent of the standard proctor as defined by ASTM D 698. The side slopes were constructed at 3H:1V on the upstream side and 2H:1V on the downstream side. The crest width is 12 feet. The upstream riprap is 12 inches thick and founded on a 12-inch thick filter base.

The principal spillway consists of a drop inlet riser connected to a 24-inch reinforced concrete pipe founded at the base of the dam. The pipe discharges at the downstream toe. The overall height of the riser is approximately 12 feet. The discharge conduit has 3 concrete anti-seep collars spaced 24 feet apart. One is at the dam centerline and the others are upstream and downstream of the centerline. Water is discharged through the pipe into a riprap lined, trapezoidal plunge pool. The embankment contains a 6-inch corrugated metal perforated pipe connected to a 6-inch corrugated metal nonperforated pipe. This pipe serves as the outlet system for the drainage trench shown on Plates 3 and 4, Appendix E.

The grass lined spillway was cut into the natural glacial sands, clays and gravels, located on the right abutment of the structure. The spillway has a bottom width of approximately 60 feet with side slopes of 2H:1V. All surfaces are protected with grass. The spillway has a 20-foot wide control section located approximately 5 feet below the embankment crest.

2.2 Construction.

A description of the construction history is presented in Section 1.2. Construction was performed under the supervision of Mr. J. E. Kuhn, Resident Engineer for the SCS. The E. P. Sodem Construction Company performed the construction associated with the dam and appurtenant structures.

2.3 Operational Data.

There are no operational records maintained. There are no minimum flow requirements for the downstream channel. There are no water level measurements or rainfall records maintained within this watershed.

2.4 Evaluation.

a. Availability. All engineering data produced in this report and studied for this investigation was provided by either the Pennsylvania Department of Environmental Resources or representatives from the Soil Conservation Service.

b. Adequacy. The data included in the State files, supplemental data received from other sources, and verbal information received from representatives for the Wayne County Commissioners are considered adequate to evaluate the dam and appurtenant structures.

c. Validity. There is no reason to question the validity of this data.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The observations and comments of the field inspection team are contained in the checklist enclosed herein as Appendix B, and are summarized and evaluated as follows. In general, the dam and its appurtenant facilities are in good condition and well maintained. Wayne County maintenance employees periodically exercise the pond drain valve, remove trash from the trash racks, and mow the grass on the dam.

b. Dam. During the visual inspection, there were no indications of distortions in alignment or grade that would be indicative of movement of the embankment or foundation. A careful inspection of the downstream slope and adjacent downstream area disclosed no seepage flow.

There were no signs of riprap distortion, movement or deterioration. The quality of the rock was assessed to be good.

There were no indications of surface cracks noted on the embankment crest or the embankment slopes. Similarly, there were no signs of sloughing or erosion of the embankment slopes and only minor erosion was noted at the abutment contacts. A diversion dike located between the right abutment of the dam and the left abutment of the emergency spillway was also inspected and observed to be in good condition. The minimum height of the dike above the emergency spillway channel is about 2 feet, approximately 66 feet downstream of the dam. Although the internal drainage system could not be inspected, the 6-inch

corrugated metal pipe which drains this system was inspected. The seepage was observed to be clear with no signs of fines at the exit of the pipe which could be indicative of an internal drainage problem. It is noted that this inspection was performed when the reservoir water level was at elevation 1,282.5± feet. Therefore, the performance of the internal drainage system under a high reservoir level could not be evaluated. Based on the past performance of this dam, a review of the design drawings and the visual inspection, there is no reason to suspect that the drainage system would not function properly under a high reservoir water level.

c. Appurtenant Structures. At the time of the inspection, water was flowing over the principal spillway weir. Portions of the riser visible from the embankment were inspected and observed to be in good condition with no signs of distress, concrete spalling, or other indications of poor construction or movement of the riser. The interior of the intake riser could not be inspected since a key was not available. Similarly, the sluice gate could not be exercised since a key to the lock was not available. However, the valve was cleaned, painted and appeared to be well lubricated.

The length of the discharge pipe could not be inspected primarily because of its size and the fact that water was flowing through the principal spillway pipe. However, the end of the pipe was inspected and observed to be in fairly good condition. The plunge pool at the downstream toe was inspected and observed to be in fair condition. There was some sloughing and erosion of primarily the right slope of the basin, which is continuing to eat away at the right side of the slope. Although this condition of sloughing and erosion of the discharge basin is not considered to be detrimental to the performance of the dam, continued erosion could lead to undermining of the principal spillway bent.

The emergency spillway is located at the right abutment of the dam and was inspected and observed to be in good condition. Both the channel bottom and the side hill slopes are well vegetated and appear to be well maintained. Both the emergency spillway entrance and exit are also in good condition.

d. Reservoir. Reconnaissance of the reservoir disclosed no evidence of significant siltation, slope instability or other features that would significantly affect the flood storage capacity of the reservoir. The drainage area surrounding the reservoir was inspected and assessed to be quite stable and well vegetated. There are a few houses along a road which bisects the drainage area approximately 3/4 of a mile upstream from the dam.

e. Downstream Channel. As shown on Plate 1, Appendix E, Lollipop Creek discharges into the Lackawaxen River at White Mills, Pennsylvania. Between Suydam Dam and the Lackawaxen River, the stream passes through one private pond, beneath a roadway, through a steep valley and finally into the Lackawaxen River. In the event of failure of Suydam Dam, the small dam below Suydam Dam Reservoir will overtop, causing damage to the road and to several houses and small industry along the creek, principally in the town of White Mills. (It is noted that the lower dam and roadway have withstood overtopping to a depth of approximately 1 foot in the past without failure.) In the event of failure of the dam, property damage and possible loss of life would most likely occur at White Mills, Pennsylvania.

3.2 Evaluation.

The inspection of the dam disclosed no evidence of apparent past or present movement that would indicate existing

instability of the dam, principal or emergency spillways. Although the pond drain sluice gate valve was not exercised during the inspection, representatives from the county indicated that the gate functioned properly. It was noted that the pond drain gate was clean, painted and appeared to be well lubricated. The interior portions of the principal spillway intake riser and discharge pipe could not be inspected due to both flow through the system and the fact that the gate key was not available. The plunge pool was inspected and some erosion was noted along the right side of the pool, which is not considered to be a major deficiency at this time. Continued erosion of this pond could eventually undermine the spillway bent, which could cause damage to the pipe.

The emergency spillway was inspected and observed to be in good condition. The spillway channel and the grass-lined side slopes were all found to be in good condition with a good, dense vegetative cover. Both the entrance channel and the end of the discharge channel were inspected and observed to be in good condition and stable.

There was very little debris noted along the reservoir shoreline and the drainage area was assessed to be well vegetated and quite stable.

Presently, the only access to the dam breast is from the west around a farm pond and across the emergency spillway, clearly impassible if the emergency spillway is flowing more than a few inches deep. Present alternate methods of approach require a hike through woods of more than half a mile.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures.

Operational procedures are discussed in some detail in Section 1.2. The operation of the dam does not require a dam tender. Under normal conditions, flow discharges over the principal spillway weir (elevation 1,285.0). Thereafter, excess water is stored up to the emergency spillway crest (elevation 1,093.0). As reported by the Owner's representatives, the water has never flowed over the emergency spillway. The dam is not monitored during periods of high precipitation and correspondingly high runoff. The reservoir can be drawn down or drained by opening the sluice gate at the base of the intake riser. The sluice gate valve is located at the top of the riser. There are no formal written operation or maintenance procedures other than a general maintenance procedure supplied by the Wayne County Commissioners through the Civil Defense Authority. However, the Soil Conservation Service inspects the structure yearly and submits its reports to appropriate authorities.

4.2 Maintenance of the Dam.

The dam is maintained by the Wayne County maintenance staff who periodically check the embankment, remove woody vegetation from around the principal spillway riser, mow the grass, and perform other minor repairs and maintenance functions.

4.3 Maintenance of Operating Facilities.

The pond drain is usually lubricated and painted, if necessary, during a periodic inspection by Wayne County employees.

4.4 Warning Systems In Effect.

The representative for the Wayne County Commissioners reported that there are no formal warning systems or procedures established to be followed during periods of heavy rainfall. If hazardous conditions develop or if high flow conditions are anticipated, the local Civil Defense Authority would be notified by the Wayne County Commissioners.

4.5 Evaluation.

It is judged that the current operating procedure, which does not require a dam tender, is a realistic means of operating the relatively simple control facility at Suydam Dam.

Since there are no formal warning procedures, it is recommended that a formal procedure be developed so downstream residents may be amply warned of possible high flows or potentially hazardous conditions. Operational procedures should also be formalized and documented. A maintenance procedure and inspection checklist similar to SCS criteria should be implemented and used.

SECTION 5

HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. Original design data could not be located with the exception of graphical flood routings in the State files. The application report (Section 2.1, reference no. 7) contained statements regarding the design of the dam. The watershed is small, approximately 1.5 miles long and 0.6 miles wide, having a total area of 0.74 square miles. Elevations range from 1,420 feet to 1,285 feet at normal pool level. The watershed is approximately 50 percent wooded and 50 percent open/farmland with very little residential development. At the upper end of the reservoir and in the upper half of the watershed are marshy areas totalling approximately 30 acres. The runoff characteristics are not expected to change significantly in the foreseeable future.

In accordance with the criteria established by the Federal (OCE) Guidelines, the recommended spillway design flood for this "Small" size dam and "High" hazard potential classification is 0.5 to 1.0 PMF (Probable Maximum Flood). The Soil Conservation Service (SCS) designed this dam as a Class C structure. This classification requires the dam to be designed to pass the PMF.

b. Experience Data. There are no records of reservoir water levels or rainfalls within this watershed. There are no estimates or records of previous high water levels.

c. Visual Observations. On the date of the inspection, no conditions were observed that would indicate that the outlet

capacity would be reduced during the flood occurrence. The only undesirable condition noted during the field inspection is a potential overtopping of the left dike of the emergency spillway. This dike has a minimum height of 24 inches about 60 feet downstream of the control section. It is estimated that flows greater than about 1,200 cfs would overtop the dike. While this is an undesirable condition, it is not considered a dangerous condition. Observations regarding the condition of the downstream channel, spillways and reservoir are located in Appendix B.

d. Overtopping Potential. The dam was designed to pass the PMF without overtopping. The PMF inflow hydrographs and flood routing are presented in Appendix C. This information was reviewed and judged adequate. In summary, the peak inflow was computed as 3,000 cfs resulting from a 6-hour storm with 25.2 inches of rainfall. This was computed to be equivalent to a runoff of 22.0 inches. This storm was routed through the reservoir to produce a peak discharge of 1,800 cfs at the maximum water level (elevation of 1,297.7) at the top of the dam. The spillway systems for this dam are considered to be "Adequate" as the dam will pass the PMF without overtopping. The tailwater is estimated to be 22 feet or more below the top of the dam during the PMF.

e. Downstream Conditions. About 2,500 feet downstream of the dam is a 7-foot high dam shown as Butcher's Pond Dam on the USGS Quadrangle Map, which is also known as Trout Lake Dam (DER #64-105). Lollipop Creek flows through White Mills before joining the Lackawaxen River approximately 4,800 feet downstream of Trout Lake Dam.

At Trout Lake Dam and in White Mills are many homes and businesses subject to damage in the event of high flows in

Lollipop Creek. During Tropical Storm Diane, August 1955, at least one building was destroyed and a stone building damaged at a point adjacent to the creek and 400 feet upstream from the Lackawaxen River. Buildings at the site were also flooded during Tropical Storm Agnes, June 1972, after Suydam Dam was built. Weather Service publications indicate one day rainfalls of 4.35 inches in 1955 and 2.45 inches in 1972. Two day rainfalls of 7.99 and 3.28 inches in 1955 and 1972 were also recorded. No estimate has been made of the maximum non-damaging flow at that point, as Suydam Dam controls only approximately 50 percent of the watershed above that point. However, because of the steep, narrow flood plain along Lollipop Creek, damage, including loss of life, would be significantly greater if the dam failed during the passing of the PMF than damage resulting from high flows just before failure during the PMF.

SECTION 6 STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. The visual observations did not detect any evidence of existing or pending embankment stability problems. The upstream riprap was stable and in quite good condition. Similarly, the vegetated slopes and crest were also assessed to be in good condition. There were no exterior signs or evidence indicating that internal drainage systems were not operating properly.

No signs of seepage were observed at the downstream toe, or in areas adjacent to the toe. Beyond the downstream toe the natural ground at the valley bottom was wet and marshy; however, the area was originally a swamp and these conditions are considered normal. As discussed in Section 3.1, the functioning of the drainage system was not inspected under a high reservoir level condition.

The exposed portions of the principal spillway were inspected and are judged to be in good condition. The pond drain valve, although it was not exercised, was observed to be clean, well painted, and apparently well lubricated. The grass-lined emergency spillway was assessed to be in good condition. There were no signs of channel wall sloughing, approach channel or discharge channel erosion. Some minor erosion was located along the right side of the plunge pool, but this condition is not considered to be critical or a hazard to the structure.

b. Design and Construction Data. Design documentation was limited to the "Report Upon the Application", progress

reports, and miscellaneous letters regarding the design located in the files of the Department of Environmental Resources (DER). The files of the U.S. Department of Agriculture Soil Conservation Service (SCS), Harrisburg, Pennsylvania, were also searched and information regarding the design of this structure could not be located. Items which could not be found were structural calculations, stability analysis, detailed flood routing information, and other calculations normally associated with the design of a reservoir and appurtenant facilities. The principal documents pertaining to the design included an 11-sheet set of design drawings prepared by the SCS.

Other than a few progress reports prepared by the SCS Resident Engineer and three inspection reports prepared by DER representatives, there was no construction information available. Although there is a lack of construction data, these inspection reports indicated that satisfactory work was performed by the contractor and that the specifications were followed without significant deviations. A cursory check of the spillway dimensions, intake tower features, as well as the discharge pipe and plunge pool measurements, together with measurement of the length of the dam and the embankment slopes, indicates that these features of the dam were constructed in general accordance with the drawings.

Since stability calculations for this embankment were not available, the stability evaluation was based on an assessment of the geometric configuration of the embankment together with an assessment of the engineering properties of the materials native to this area. This assessment indicates that the cross-section presented on Plate 3, Appendix E, appears reasonable. The upstream and downstream slopes and the crest width are reasonable for an embankment composed of local material compacted to the specification requirements of at least 95 percent of Standard Proctor Density (ASTM D 698).

c. Operating Records. There are no operational records for this structure.

d. Post-Construction Changes. There are no reports nor is there any evidence that modifications were made to this dam.

e. Seismic Stability. The dam is located in Seismic Zone 1. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake conditions. Since the results of the static stability analysis were not available, an assessment of the seismic stability of the dam is also unknown.

SECTION 7
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Evaluation. The visual inspection and review of the very limited design and construction documentation indicates that the dam, foundation and appurtenant structures of Suydam Dam are in good condition. It is noted that the pool level at the time of the inspection was low and, therefore, the performance of the dam and internal drainage system under high pool level could not be assessed. The hydrologic and hydraulic computations presented in Appendix C indicate that the dam will pass the Probable Maximum Flood (PMF) without overtopping. Therefore, the spillway systems of this structure are considered to be "Adequate". It is noted that although the structure will pass the PMF, overtopping of the downstream Butcher Pond Dam will occur with considerable property damage. Property damage through the town of White Mills would occur during severe storms before Lollipop Creek discharges into the Lackawaxen River. In the event of failure, it is expected that extreme property damage and possible loss of life would most likely occur.

b. Adequacy of Information. The limited information available for this investigation was sufficiently adequate to evaluate the structure.

c. Urgency. It is recommended that the suggestions presented in Section 7.2 be implemented as soon as practical.

7.2 Remedial Measures.

a. Facilities. It is recommended that the following measures be undertaken.

1. The plunge pool should be checked after each severe storm for scour and for possible undermining of the spillway bent.
2. An alternate means of gaining access to the dam during periods of flow over the emergency spillway should be established so the dam can be monitored. This zone would probably be inaccessible during periods of high precipitation.
3. Inspect and evaluate the performance of the internal drain during periods of high pool level.

b. Operation and Maintenance Procedures. Because of the location of the dam upstream from the highly populated area of White Mills, Pennsylvania, a formal procedure of observation and warning during periods of high precipitation should be developed and implemented. This procedure should include a method of warning downstream residents and industries. It is noted that in the event that the emergency spillway is used, access to the dam for monitoring would be extremely limited.

The Owner should also develop an operation and maintenance procedure to be used to insure that the dam is operated in a safe manner and maintained in the best condition possible.

APPENDIX

A

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Suydam Dam
ID # PA 00085

Sheet 1 of 4

REMARKS
Only SCS design drawings were available from DER files.

REGIONAL VICINITY MAP
See Plate 1, Appendix E.

CONSTRUCTION HISTORY
21 black and white construction photos were available in DER files together with a few letters of correspondence. Otherwise, details of the construction history are very sparse.

TYPICAL SECTIONS OF DAM
See Appendix E.

OUTLETS - PLAN
DETAILS
See Appendix E.

CONSTRAINTS
DISCHARGE RATINGS
None available but DER files did contain a two-sheet set of Flood Routing Hydrographs for six hour storms.

RAINFALL/RESERVOIR RECORDS
None available.

ITEM	REMARKS
DESIGN REPORTS	<i>None available in DER files.</i>
GEOLOGY REPORTS	<i>None available in DER files. See Appendix F.</i>
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	<i>None available in DER files.</i>
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	<i>None available in DER files.</i>
POST-CONSTRUCTION SURVEYS OF DAM	<i>None</i>
BORROW SOURCES	<i>Data not available.</i>

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	None
HIGH POOL RECORDS	Not available.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None known.
MAINTENANCE OPERATION RECORDS	None

ITEM	REMARKS
<div>SPILLWAY PLAIN</div> <div> <div>SECTIONS</div> <div>DETAILS</div> </div>	<div>See Appendix E.</div>
<div>OPERATING EQUIPMENT</div> <div>PLANS & DETAILS</div>	<div>See Appendix E.</div>
<div>MISCELLANEOUS</div>	<div> <div>1. SCS yearly inspection reports through 1978.</div> <div>2. "Report Upon the Application of Frederick Suydam", March 6, 1959.</div> <div>3. "Application Report" dated 6 March 1959.</div> <div>4. "Permit" issued 8 April 1959.</div> </div>

APPENDIX

B

CHECK LIST
VISUAL INSPECTION
PHASE I

Sheet 1 of 11

Name Dam Suydam Dam County Wayne State Pennsylvania National ID # PA 00085
Type of Dam Earth Hazard Category I (High)
Date(s) Inspection 24 Oct. 78 & 25 Oct. 78 Weather Clear & Cool Temperature 40's

Pool Elevation at Time of Inspection 1282½ ± M.S.L. Tailwater at Time of Inspection 1271 ± M.S.L.

Inspection Personnel:

Mary Beck (Hydrologist) Vincent McKeever (Hydrologist) John H. Frederick
John Boschuk, Jr. (Geotech- nical/Civil) Raymond Lambert (Geologist)

John Boschuk, Jr. Recorder

Remarks:

Mr. George Casper, Bridge and Watershed Manager, represented the county and was on site
to assist the inspection team.

CONCRETE/MASONRY DAMS

Sheet 2 of 11

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
ANY NOTICEABLE SEEPAGE	N/A	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
DRAINS	N/A	
WATER PASSAGES	N/A	
FOUNDATION	N/A	

CONCRETE/MASONRY DAMS

Sheet 3 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N/A	
STRUCTURAL CRACKING	N/A	
VERTICAL AND HORIZONTAL ALIGNMENT	N/A	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	

EMBANKMENT

Sheet 4 of 11

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
SURFACE CRACKS	<i>None observed.</i>	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	<i>None observed.</i>	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	<i>No unusual movement, erosion or slope sloughing was observed. However, erosion was noted around the outlet system. See the discussion on Sheet 6 of 11.</i>	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	<i>No unusual movements were observed.</i>	
RIPRAP FAILURES	<i>None observed.</i>	

EMBANKMENT

Sheet 5 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

CREST

The crest and slope had many slight undulations which were assessed to be as a result of construction.

JUNCTION OF EMBANKMENT
AND ABUTMENT, SPILLWAY
AND DAM

There were no unusual or seriously undesirable movements or distortions observed at the various contacts of the dam components.

ANY NOTICEABLE SEEPAGE

A few small wet areas were observed which are not considered to be of immediate concern. They should be monitored during SCS yearly inspections.

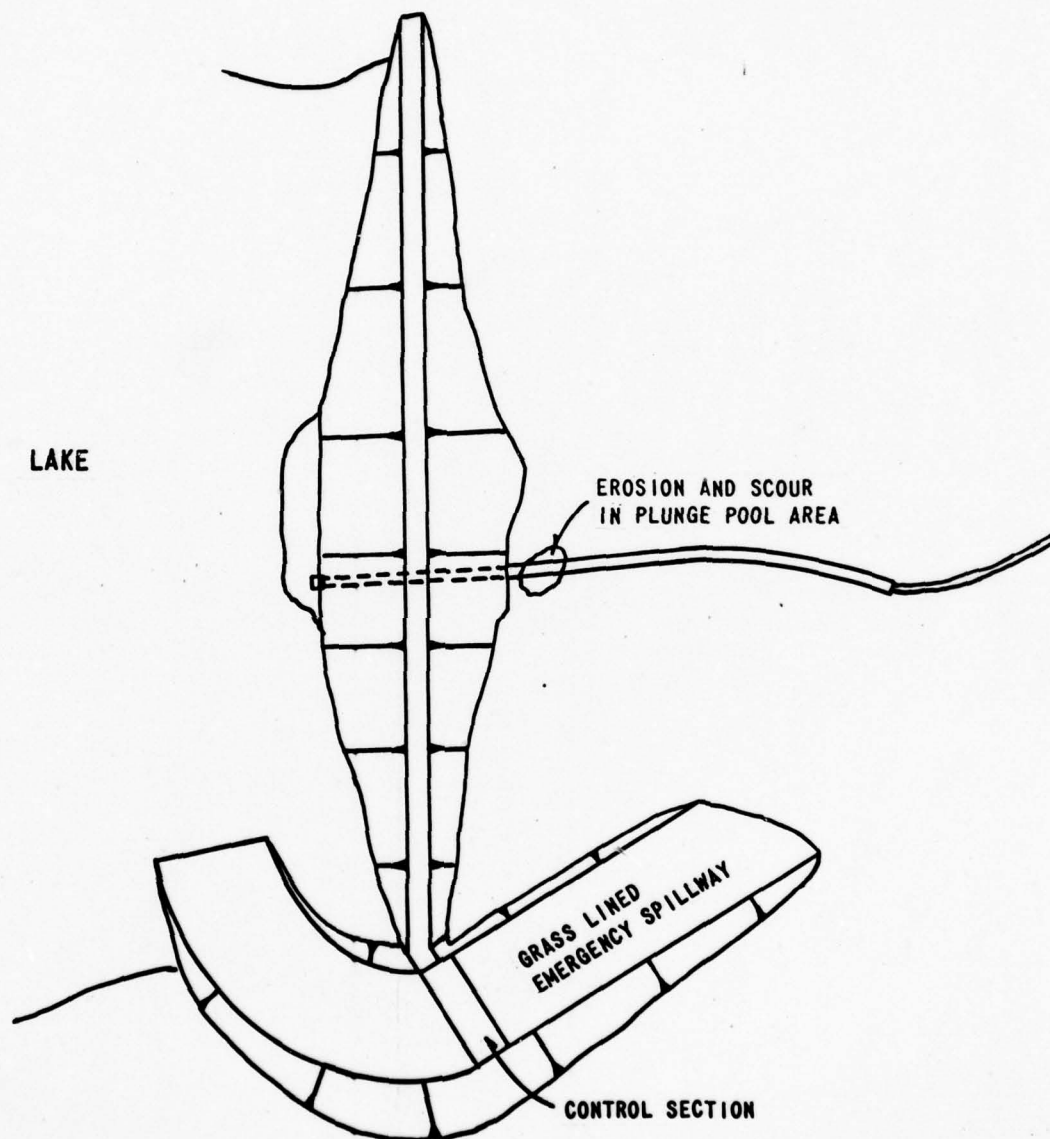
STAFF GAGE AND RECORDER

None

DRAINS

Two - 6 inch CMP were observed on each side of the principal spillway outlet pipe. Both were seeping water at rates of less than 0.01 gpm.

LAKE



SEEPAGE LOCATION PLAN
SUYDAM DAM

SHEET 5a OF 11

OUTLET WORKS

Sheet 6 of 11

VISUAL EXAMINATION OF CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
	None observed.	
INTAKE STRUCTURE	The portions of the structure above the water line were inspected and found to be in good condition. The access to the structure was locked and could not be inspected. Mr. Casper stated that the drain valve functioned and was exercised and lubricated two times per year. It could not be operated during the inspection because there was no means of access to the structure.	
OUTLET STRUCTURE	The outlet of the 24 inch concrete pipe was found to be in good condition.	
OUTLET CHANNEL	The outlet plunge pool is experiencing some erosion. See the photographs in Appendix D. Since the condition is undesirable, stabilization measures should be implemented such as regrading and riprap.	
EMERGENCY GATE (POND DRAIN)	Could not be operated.	

UNGATED SPILLWAY
(EMERGENCY SPILLWAY)

Sheet 7 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

CONCRETE WEIR

None. Grass spillway.

APPROACH CHANNEL

Grass lined channel in good condition. Side slopes in good condition.

DISCHARGE CHANNEL

Grass lined channel in good condition. Side slopes in good condition.

BRIDGE AND PIERS

None

GATED SPILLWAY

Sheet 8 of 11

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CONCRETE SILL	None	
APPROACH CHANNEL	None	
DISCHARGE CHANNEL	None	
BRIDGE AND PIERS	None	
GATES AND OPERATION EQUIPMENT	None	

INSTRUMENTATION

Sheet 9 of 11

VISUAL EXAMINATION

OBSERVATIONS

REMARKS OR RECOMMENDATIONS

MONUMENTATION/SURVEYS

None

OBSERVATION WELLS

None

WEIRS

None

PIEZOMETERS

None

OTHER

RESERVOIR

Sheet 10 of 11

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
------------------------------	---------------------	-----------------------------------

SLOPES

Moderate slopes, well vegetated at lower end of reservoir and grass at the upper end. Little or no debris evident.

SEDIMENTATION

Minimal sedimentation, no effect on flood storage.

DOWNSTREAM CHANNEL

Sheet 11 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Immediately below the dam, the stream flows through a wooded flood plain containing light underbrush. The channel makes two 90 degree bends as it meanders through the flood plain.	
SLOPES	The valley gradient is about two percent. The bank slope varies from vertical to about 2H:1V.	
APPROXIMATE NO. OF HOMES AND POPULATION	The creek meanders approximately 1½ miles downstream passing through Butchers Pond, a small retention pond and empties into the Lackawanna River. Between the retention pond and the river the stream flows through the business section of White Mills. See details on Plate 1, Appendix E.	

APPENDIX

C

SUYDAM DAM
CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATADRAINAGE AREA CHARACTERISTICS: 50% wooded, 50% open/farm, very little residential development.ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1285 ft. (33 Acre-Feet)ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1298 ft. (433 Acre-Feet)ELEVATION MAXIMUM DESIGN POOL: 1296.2 feet.ELEVATION TOP DAM: 1298.0 feet.

EMERGENCY SPILLWAY

a. Elevation 1293.0 feetb. Type Trapezoidal channel cut through natural materials.c. Width 60 feet.d. Length Approximately 370 feet.e. Location Spillover Right abutment.f. Number and Type of Gates None.

OUTLET WORKS:

a. Type Drop inlet riser, conduit and plunge pool.b. Location Approximately 210 feet from right abutment.c. Entrance inverts Weir, 1285 feet; low stage inlet, 1282.5 feet.d. Exit inverts 1272.0 feet.e. Emergency draindown facilities 12 inch pond drain at 1276.5 feet.

HYDROMETEOROLOGICAL GAGES:

a. Type Noneb. Location N/Ac. Records N/AMAXIMUM NON-DAMAGING DISCHARGE: Not determined.

DAM SAFETY ANALYSIS
HYDROLOGIC/HYDRAULIC DATA

Date: 11/17/70
By: MFB
Sheet: 2 of 10

DAM Suydam Dam Nat. ID No. PA 00085 DER No. 64-169

ITEM/UNITS	Permit/Design Files (A)	Calc. from Files/Other (B)	Calc. from Observations (C)
1. Min. Crest Elev., ft.	<u>1298.0</u>		
2. Freeboard, ft.	<u>0.3</u>		
3. Spillway ⁽¹⁾ Crest Elev, ft.	<u>1293.0</u>		
3a. Secondary ⁽²⁾ Crest Elev, ft.	<u>1285.0</u>		
4. Max. Pool Elev., ft.	<u>1292.7</u>		
5. Max. Outflow ⁽³⁾ , cfs	<u>1800.</u>		
6. Drainage Area, mi ²	<u>0.7</u>		<u>0.74</u>
7. Max Inflow ⁽⁴⁾ , cfs	<u>3000</u>		<u>2953</u>
8. Reservoir Surf. Area, Acre	<u>5.8 @ el. 1282.5</u>		<u>9</u>
9. Flood Storage ⁽⁵⁾ , Ac-Ft	<u>400</u>		

Reference all figures by number or calculation on attached sheets:

Example: 3A - Drawing No. xxx by J. Doe, Engr., in State File No. yyyy.

NOTES:

- (1) Main emergency spillway.
- (2) Secondary ungated spillway.
- (3) At maximum pool, with freeboard, ungated spillways only.
- (4) For columns B, C, use PMF.
- (5) Between lowest ungated spillway and maximum pool.

Date: 11/12/78
By: HFB
Sheet: 3 of 10

HYDROLOGIC/HYDRAULIC CALCULATIONS (cont.)

Item (from Sheet 2)	Source
1A, 3A, 3aA, 8A	Construction drawings prepared by SCS, 1958
2A, 4A, 5A, 6A, 7A, 9A	Flood routings prepared by SCS, 1958
6C, 8C	USGS Map White Mills, PA (1973)
7C	Computer program, see sheet 9

HEC-1, REVISED
FLOOD HYDROGRAPH PACKAGE

The original "Flood Hydrograph Package" (HEC-1), developed by the Hydrologic Engineering Center, Corps of Engineers, has been modified for use under the National Dam Inspection Program. The "Flood Hydrograph Package (HEC-1), Dam Safety Version", hereinafter referred to as, HEC-1, Rev., has been modified to require less detailed input and to include a dam breach analysis. The required input is obtained from the field inspection of a dam, any available design/evaluation data, relatively simple hydraulic calculations, or information from the USGS Quandrangle maps. The input format is flexible in order to reflect any unique characteristics of an individual dam.

HEC-1, Rev. computes a reservoir inflow hydrograph based on individual watershed characteristics such as: area, percentage of impervious surface area, watershed shape, and hydrograph characteristics determined from regional correlation studies by the Corps of Engineers, Baltimore District. The inflow is routed through the reservoir using spillway discharge data obtained from the field inspection or design data. Flood storage capacity is determined from USGS maps or design information and verified by the field inspection. In the event a spillway cannot discharge 0.5 PMF without overtopping and failure of the dam, downstream channel characteristics obtained from the field inspection and USGS maps are inputted and flows are routed downstream to the damage center and a dam breach analysis is performed.

Included in this Appendix are the HEC-1, Rev. pertinent input values and a summary print-out tables.

BY MFB DATE 11/17/78

SUBJECT

SHEET 5 OF 10CHKD. BY [Signature] DATE 4 Dec 79Suydam Dam

JOB No.

Hydrology / Hydraulics

Classification (Ref. Recommended Guidelines for Safety Inspection of Dams)

1. The hazard potential is rated as HIGH as there would be loss of life if the dam failed.
2. The size classification is SMALL based on its 24 ft. height and total storage of 433 Ac-Ft. (to top of dam).
3. The spillway design flood, based on size and hazard classification, is 0.5 to 1.0 PMF (Probable Maximum Flood).

Hydrologic / Hydraulic Analysis

Design information available for review is included in this report as Plates in Appendix E and on sheet 10A of this Appendix. The PMF inflow hydrograph and flood routing were determined according to procedures in the SCS National Engineering Handbook, Sections 4 & 5.

The components of the flood routing were determined to be adequate by the following methods:

1. The elevation-storage curve. Areas from the SCS reservoir area drawing were measured and volumes computed.

elev.	area	Δ vol.	total vol.
		11.0 Ac-Ft	
1282.5	5.8 Ac		11.0 Ac-Ft
		22.4 Ac-Ft	
1285.0	18.1 Ac		33.4 Ac-Ft
		400. Ac-Ft	
1298.0			433.4 Ac-Ft
1300.0	57.4 Ac		

Checks as maximum
available flood storage
on flood routing

BY MFB DATE 11/30/78

SUBJECT

SHEET 6 OF 10

CHKD. BY

DATE 4 Dec 78Snydam Dam

JOB No.

Hydrology / Hydraulics

2. The elevation-discharge curve, checked using current SCS criteria, TR-55.
 Total head forcing flow in emergency spillway, H_p , is 5 ft (field checked).
 Critical specific energy, H_{ec} , is about 4.4 ft from ES-171, sheet 2.
 Critical depth, d_c , = 3.0 ES-174, sheet 5
 Critical discharge, Q_c , = 1880 cfs ES-174, sheet 5
 1880 cfs > 1800 cfs max. discharge used in the flood routing.
3. The inflow hydrograph was checked by the computer program. Sheet 9 indicates peak inflow value of 2953 cfs, about the same as the peak of the inflow hydrograph used in flood routing.
4. The outflow hydrograph was checked according to SCS methods and found adequate. (Ref. - National Engineering Handbook, Section 5.)

Check on normal depth of maximum discharge in emergency spillway by Manning's Equation.

$$Q = a \cdot \frac{1.486}{n} \left(\frac{a}{W.P.} \right)^{2/3} S^{1/2}$$

use $Q = 1800$ cfs ✓
 $n = 0.04$ ✓
 $b = 60$ ft ✓
 $z = 2$ ✓
 $S = 0.027$ ✓

$$Q = d_n(b + 2d_n) \left(\frac{b d_n + 2d_n^2}{b + 2d_n \sqrt{z^2 + 1}} \right)^{2/3} S^{1/2} \frac{1.486}{n}$$

$$1800 = d_n(60 + 2d_n) \left(\frac{60d_n + 2d_n^2}{60 + 2d_n \sqrt{5}} \right)^{2/3} 0.027^{1/2} \frac{1.486}{0.04} \checkmark$$

if $d_n = 2.55$ ft

$$1800 \approx 1778 \text{ cfs} \quad d_n < d_c = 3.0 \text{ ft.} \checkmark$$

Therefore, flow in discharge channel is supercritical.

MFB

11/30/78

Suydam Dam
Hydrology / Hydraulics

SH. 7 OF 10

SUYDAM DAM
NAT ID NO. PA 00085 DER NO. 64-169
INFLOW HYDROGRAPH

JOB SPECIFICATION									
NO	NHR	NNIN	IDAY	IHR	ININ	METRC	IPLT	IPRT	NSTAN
50	0	15	0	0	0	0	0	4	0
			JOPER	NUT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 1 LRTIO= 1

RTIOS= 1.00

MFB

11/30/78

Snydam Dam Hydrology / Hydraulics

SH. B OF 10

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH USING SCS AND NO HOP BROOK
 ISTAQ ICOMP IECON ITAPE JPLI JPRT INAME ISTAGE IAUTO
 NO 0 0 0 0 0 0 0 0 0 0 0 0

HYDROGRAPH DATA
 INYDG IUNG TAREA SNAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL
 1 2 .70 0.00 .70 1.00 0.000 0 1 0

PRECIP DATA
 SPFE PMS R6 R12 R24 R48 R72 R96
 0.00 21.00 111.00 123.00 133.00 0.00 0.00 0.00

LOSS DATA
 LROPT STRKR DLTGR RTIOL ERAIN STRKS RTIOL STRTL CNSTL ALSMX RTIMP
 0 0.00 0.00 1.00 0.00 0.00 1.00 -1.00 -72.00 0.00 0.00

CURVE NO = -72.00 WEIKNSS = -1.00 EFFECT CN = 72.00

UNIT HYDROGRAPH DATA
 TC= 0.00 LAB= 1.00

RECESSION DATA
 STRID= -1.50 GRCSN= -.05 RTIOR= 2.00

END-OF-PERIOD FLOW
 NO.DA HR.MN PERIOD RAIN EXCS LOSS COMP Q NO.DA HR.MN PERIOD RAIN EXCS LOSS COMP Q

SUM 27.93 23.75 4.18 42508.
 (709.) (603.) (106.) (1203.69)

MFB

11/30/78

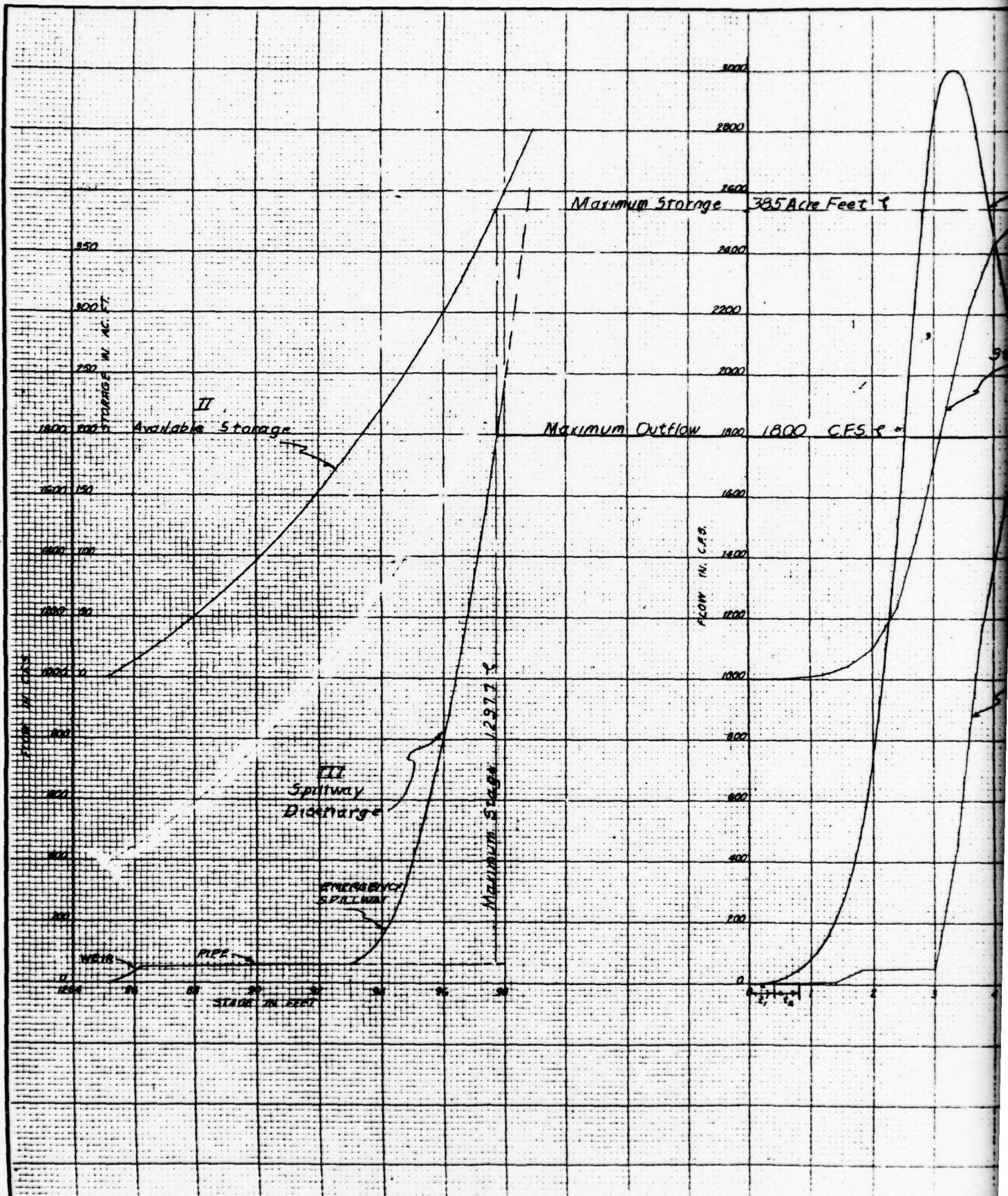
Suydam Dam
Hydrology / Hydraulics

SH. 9 OF 10

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

RATIOS APPLIED TO FLOWS

OPERATION	STATION	AREA	PLAN RATIO	1
				1.00
HYDROGRAPH AT	NO	.70	1	2953.
	(1.81)	(83.61)(



HYDROLOGIC DATA

(1) CATCHMENT AREA • 446 ACRES
 (2) RAINFALL • 2.92 INCHES
 (3) TIME CONCENTRATION • 164 HOURS
 (4) CURVE NO • 72

2

I
Inflow Hydrograph

CHECK

$$\frac{22.54 \text{ Sq. in.} \times 3600 \times 200}{43560} = \frac{373 \text{ Ac. Ft.}}{1.5 \text{ Error} = 3.1\%}$$

V
Storage

VI
Outflow Hydrograph

$$T = \frac{50 \times 736}{200} = 182 \text{ Min.}$$

TIME IN HOURS

FLOOD ROUTING - 2 1/2 x 6 Hr Pt Rainfall-II
 LACKAWAXEN TRIB WATERSHED
 PROTECTION PROJECT SITE PA-41B
 WAYNE COUNTY, PA

U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

Designed	Date
J. RISE DORFER	9-58
Drawn	
J. STOCK	9-58
Traced	

SHEET 10A OF 10

APPENDIX

D



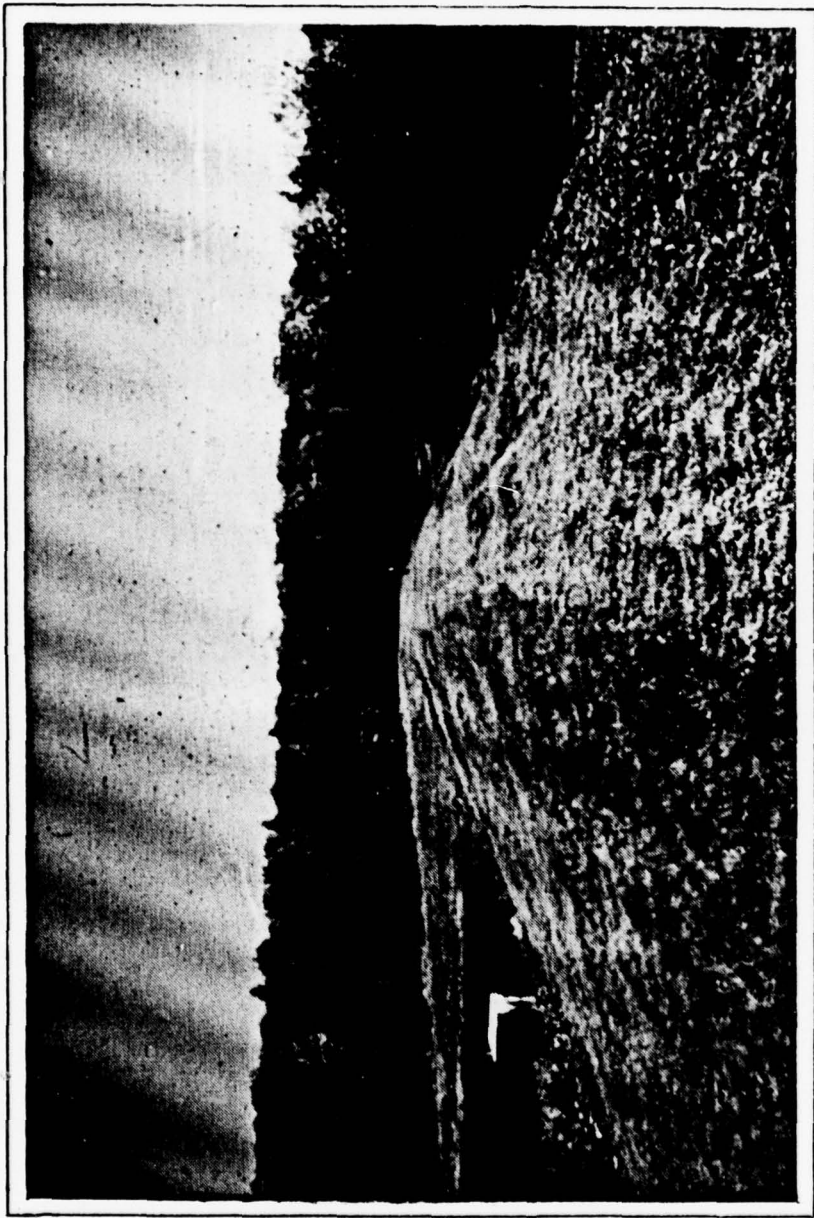
VIEW OF THE INTAKE RISER, PRINCIPAL
SPILLWAY.

PHOTOGRAPH NO. 1



PRINCIPAL SPILLWAY. DISCHARGE PIPE.

PHOTOGRAPH NO. 2



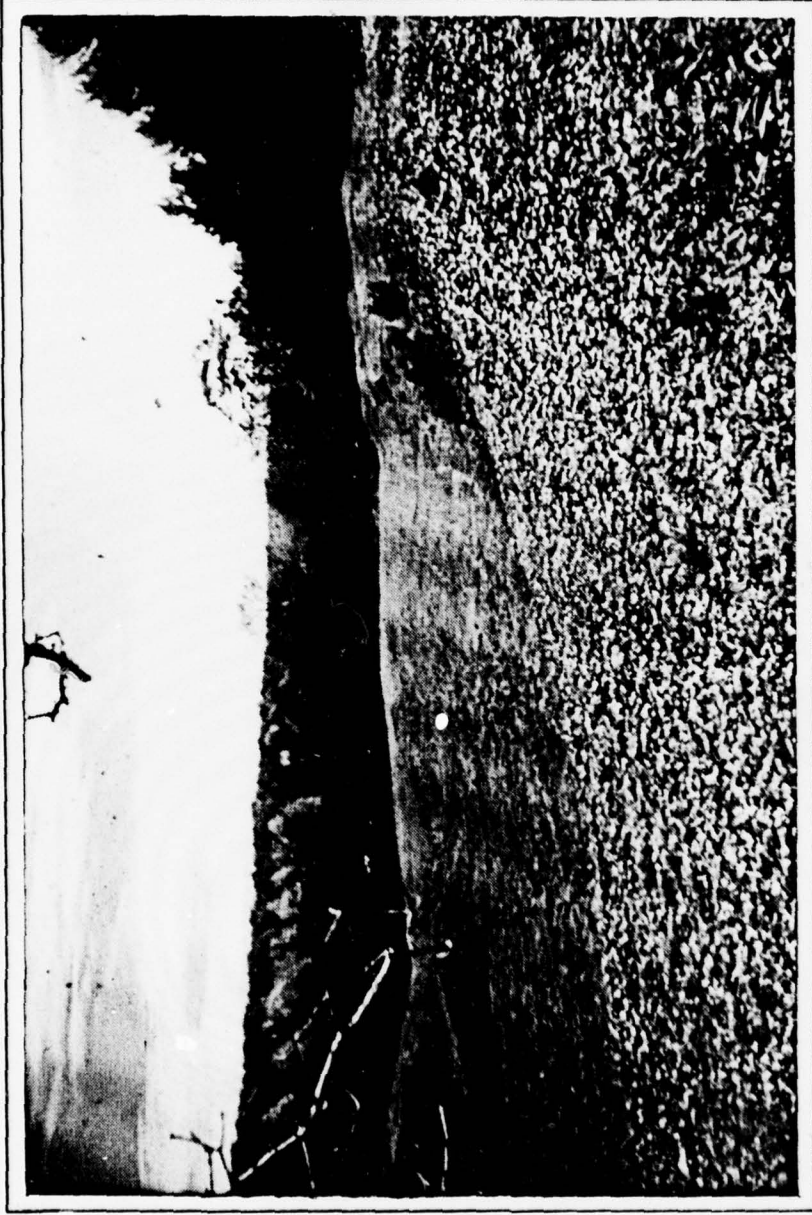
OVERVIEW OF DAM AND UPSTREAM SLOPE.

PHOTOGRAPH NO. 3



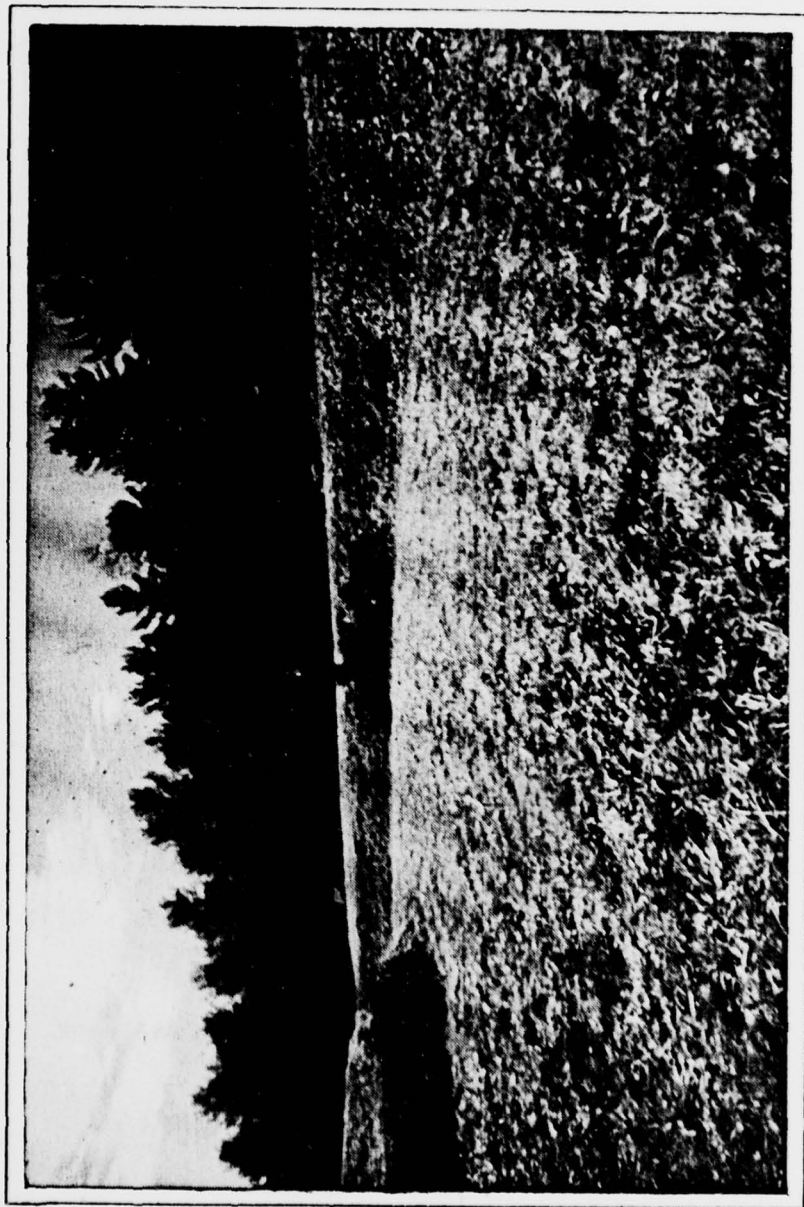
UPSTREAM RIPRAP

PHOTOGRAPH NO. 4



OVERVIEW OF EMERGENCY SPILLWAY.
LOOKING DOWNSTREAM.

PHOTOGRAPH NO. 5



EMERGENCY SPILLWAY LOOKING
DOWNSTREAM.



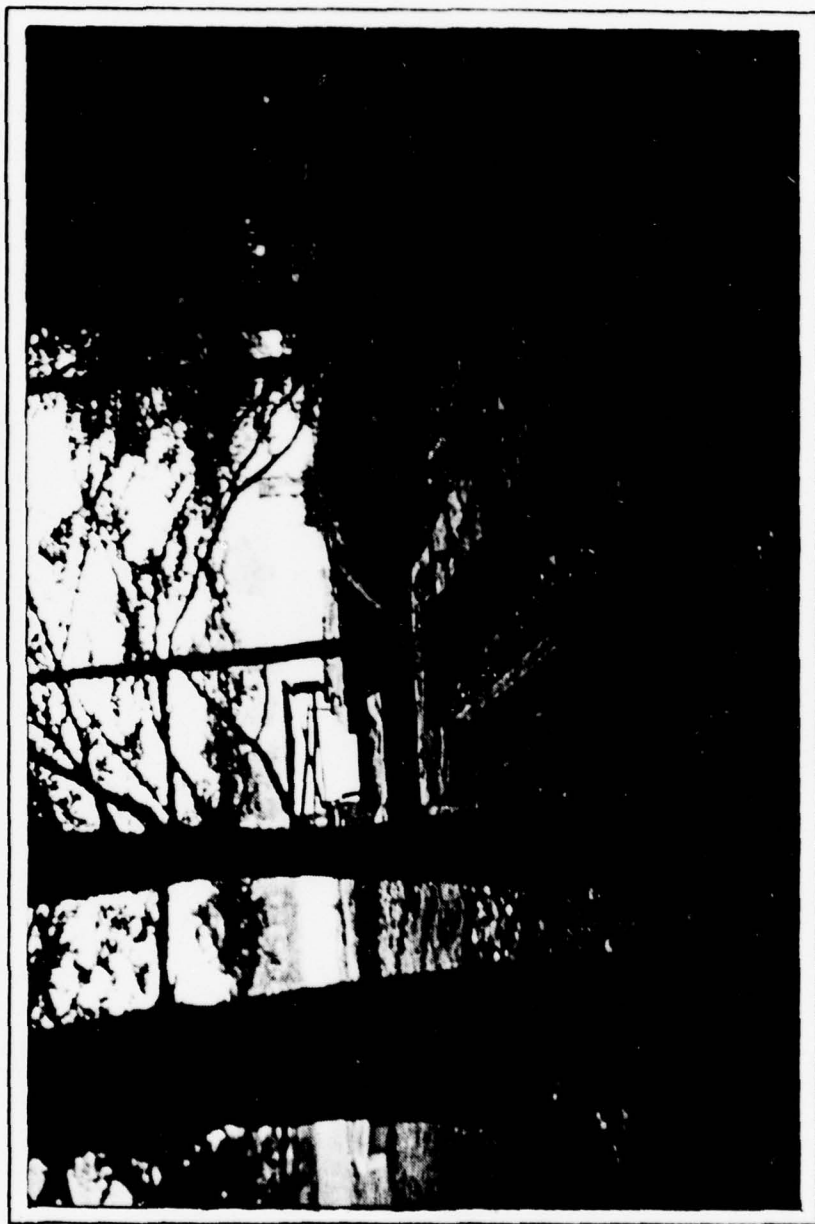
VIEW OF 6 INCH ID EMBANKMENT
DRAINAGE PIPE LOCATED ON LEFT
SIDE OF PRINCIPAL SPILLWAY
DISCHARGE PIPE.

PHOTOGRAPH NO. 7



SLOPE SLOUGHING DOWNSTREAM OF
PRINCIPAL SPILLWAY DISCHARGE
PIPE.

PHOTOGRAPH NO. 8



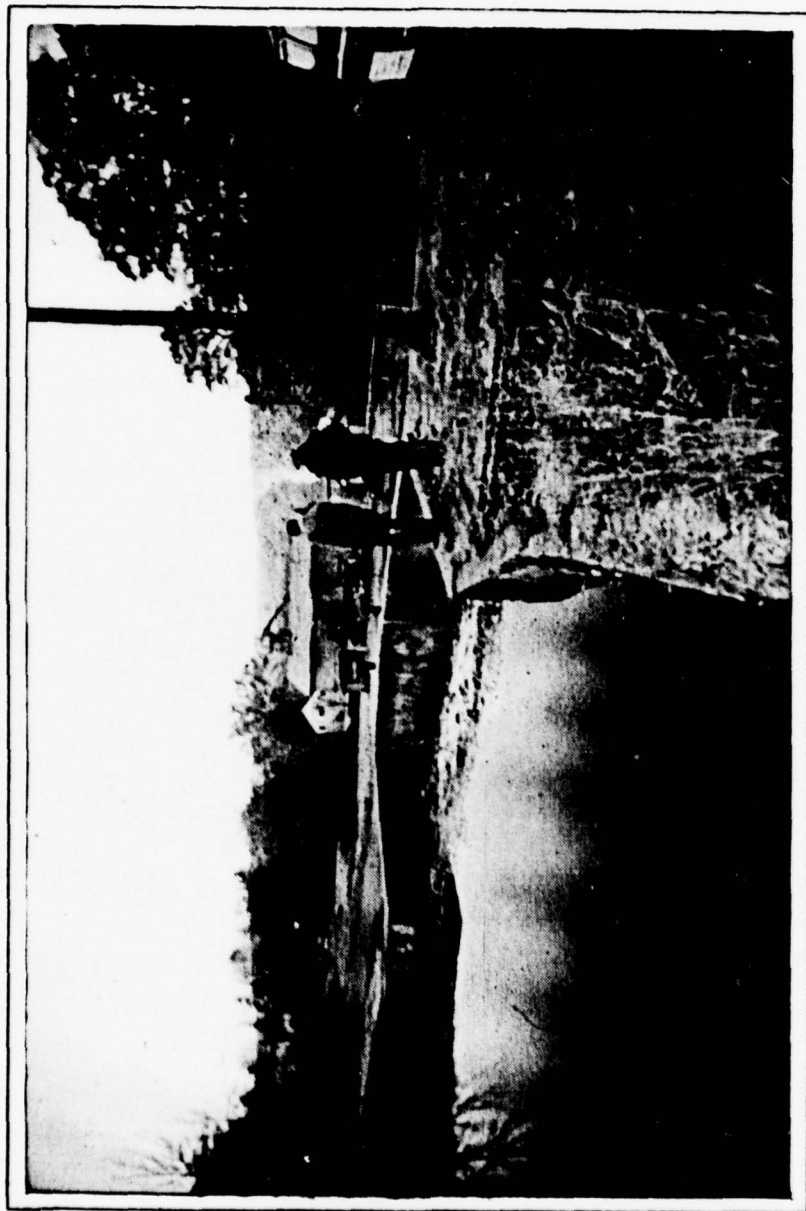
VIEW OF SPILLWAY AND RESERVOIR
LOCATED DOWNSTREAM OF SUYDAM DAM.

PHOTOGRAPH NO. 9



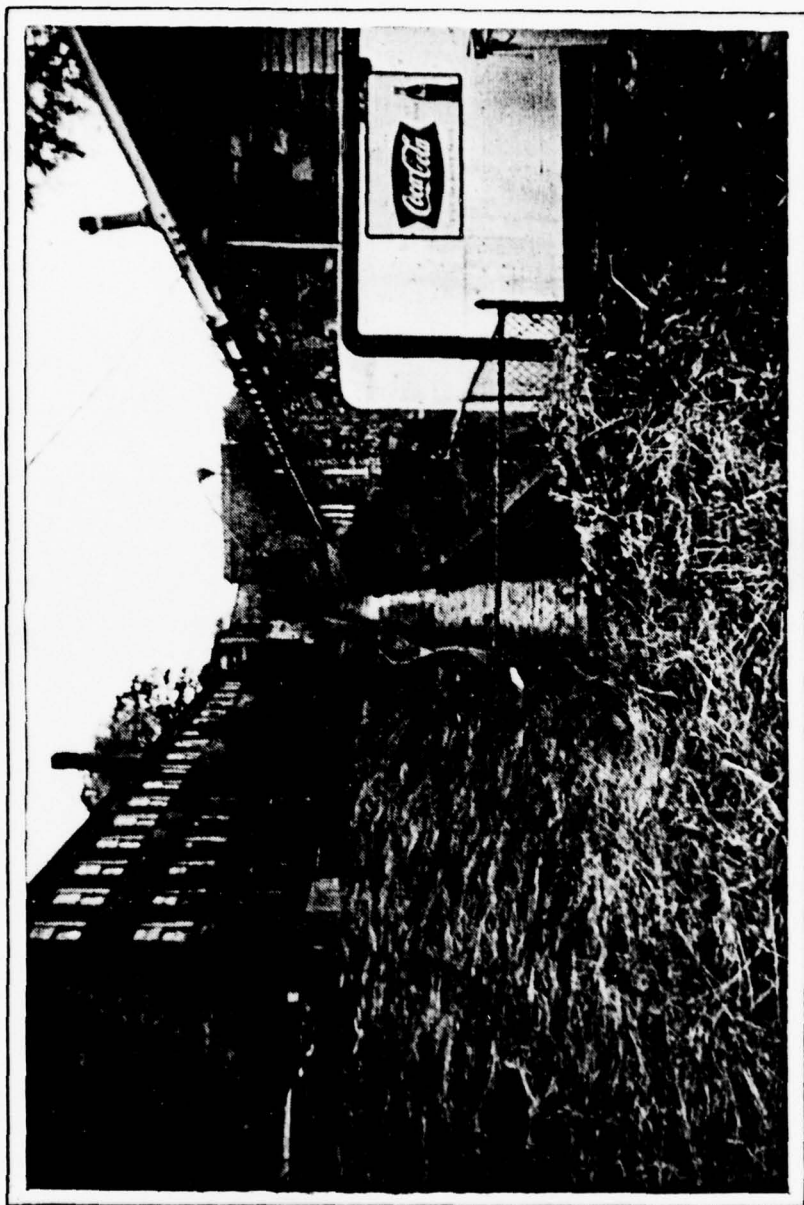
DISCHARGE CHANNEL UNDER ROADWAY
JUST BELOW THE DAM SHOWN IN
PHOTOGRAPH NO. 9

PHOTOGRAPH NO. 10



RETENTION POND ALONG DISCHARGE
CHANNEL JUST BEFORE STREAM ENTERS
BUSINESS SECTION OF TOWN.

PHOTOGRAPH NO. 11

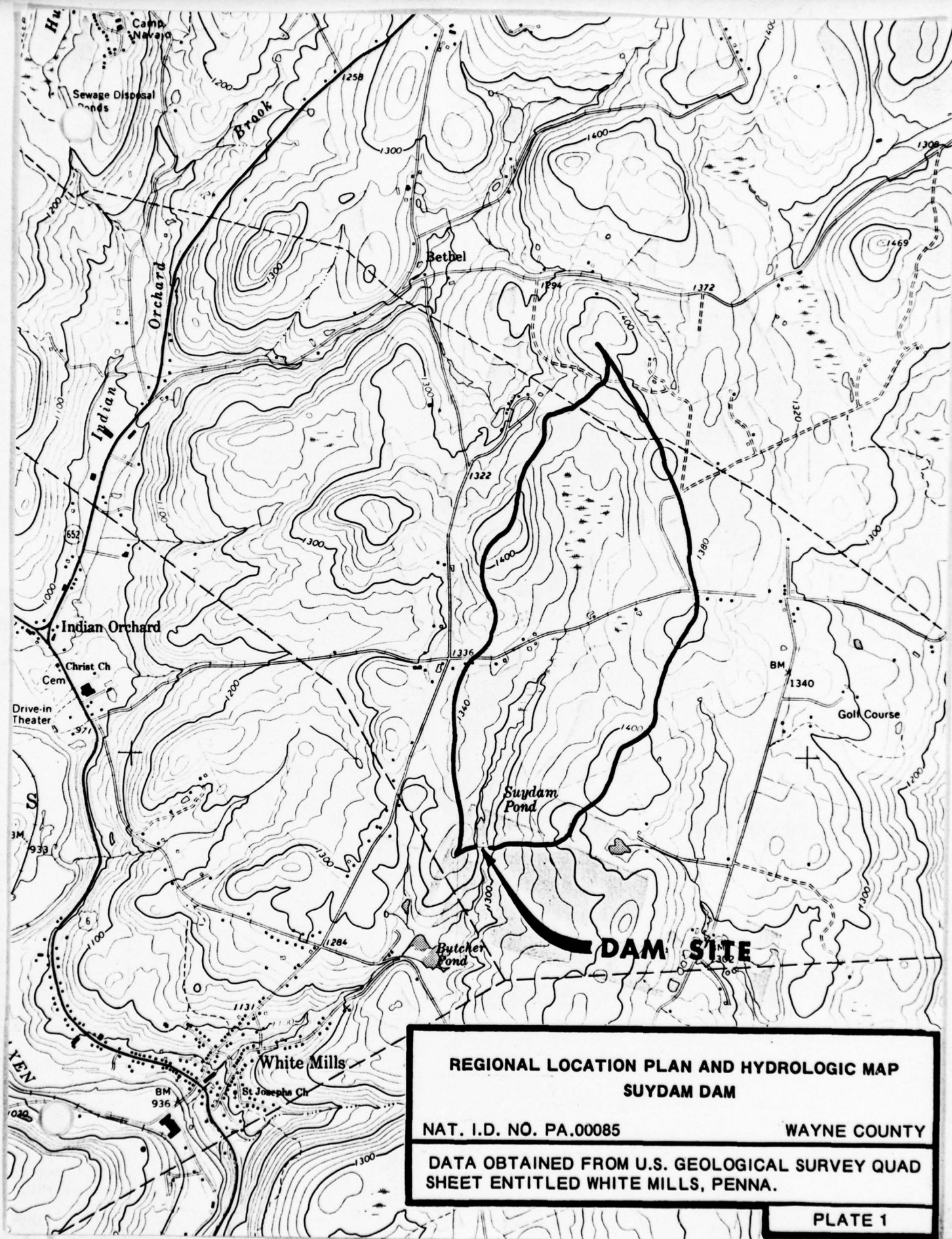


DISCHARGE CHANNEL THROUGH TOWN.

PHOTOGRAPH NO. 12

APPENDIX

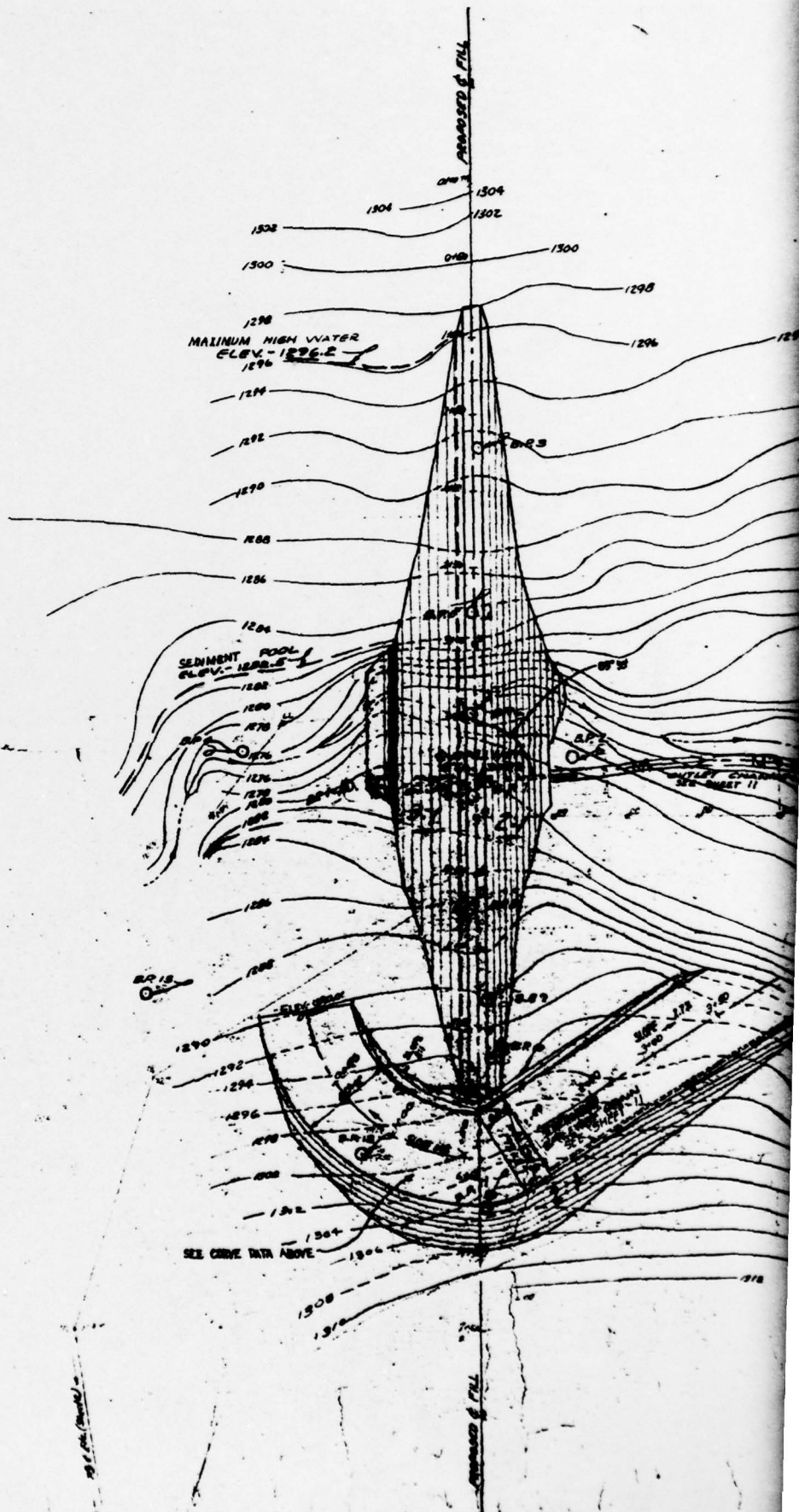
E



NOTE:

AREA TO BE CLEARED & GRUBBED ARE UNDER:
DAM & DIKE, BORROW AREA, EMERGENCY SPILLWAY AND
OUTLET CHANNEL.

AREA TO BE CLEARED IS UNDER THE
SEDIMENT POOL.



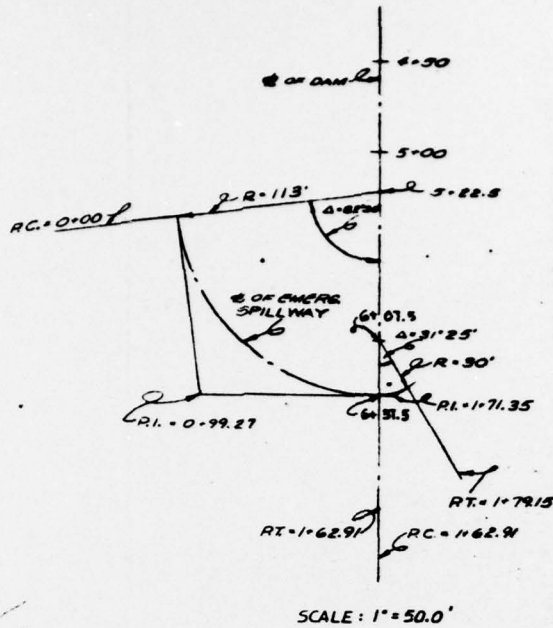
CURVE I

R = 113'
 Δ = 82°36'
 L = 162.905
 T = 99.273
 M = 28.108
 E = 37.413
 RC = 0+00.00
 RL = 0+99.27
 RT = 1+62.91

Sta	Def. L	Chord
RC 0+00	0°	0
0+25	0°20'15"	24.87
0+50	1°40'15"	24.87
0+75	1°40'15"	24.87
1+00	0°20'15"	24.87
1+25	3°41'30"	24.87
1+50	3°41'30"	24.87
RT 1+62.91	0°	12.90

CURVE II

R = 30'
 Δ = 31°25'
 L = 16.449
 LC = 16.244
 T = 8.437
 M = 1.121
 E = 1.164
 RC = 1+62.91
 RL = 1+71.35
 RT = 1+79.15



NOTE:

EARTH FILL SHALL BE:
 COMPACTED FILL, CLASS B-3, SPEC. 5-58

PLACING TOP SOIL:
 TOP SOIL REMOVED & STOCKPILED IN STRIPING
 OPERATIONS SHALL BE PLACED ON THE EMERGENCY
 SPILLWAY AND ON THE EMBANKMENTS AS
 DIRECTED BY THE ENGINEER.

EXCAVATION

ALL EXCAVATION CONSIDERED TO BE COMMON
 SPEC. - PA 4-58.

MAP SYMBOLS

- Test Pit
- Stream
- 1245- Contour Line
- Center Line
- Constructed Outlet
- Rock Rip-Rap
- ▲ View North
- TP Turning Points
- - - Base Line
- Proposed

PLAN OF DAM AND APPURTENANCES SUYDAM DAM

NAT. I.D. NO. PA.00085

WAYNE COUNTY

DATA OBTAINED FROM U.S. DEPT. OF AGRICULTURE, SOIL
 CONSERVATION SERVICE, DRAWING NO. PA.-418-P, SHEET
 NO. 3 OF 11, DATED 10/58

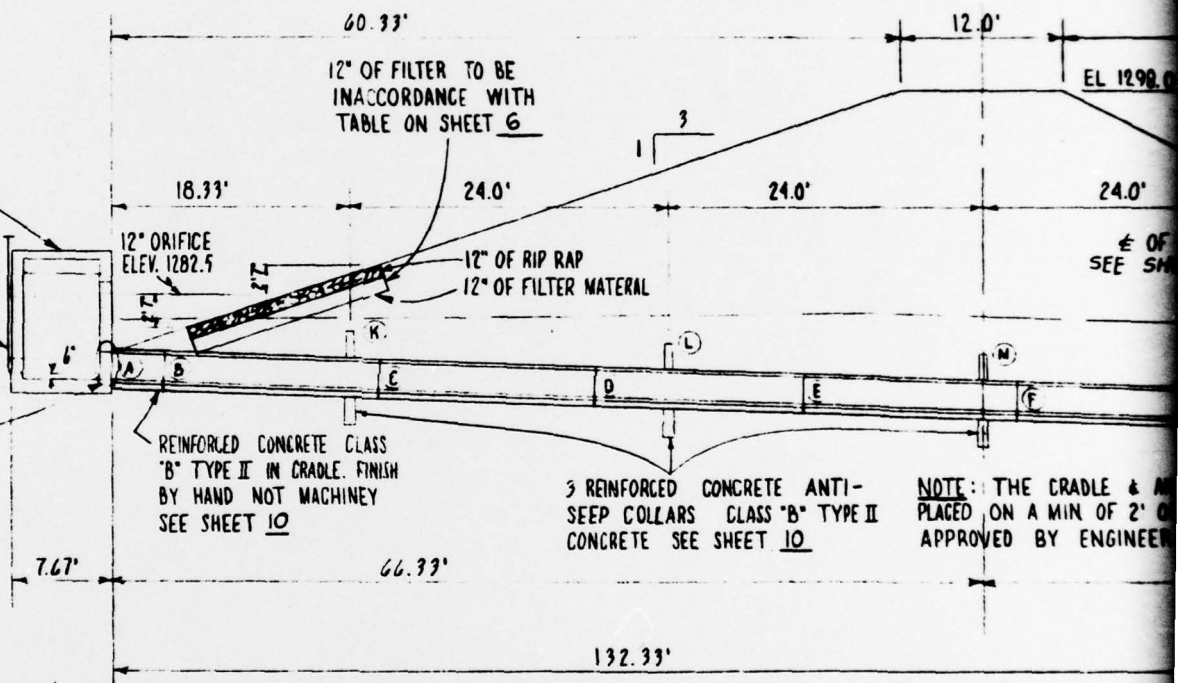
PLATE 2

REINFORCED CONCRETE RISER
CLASS "B" TYPE I
SEE SHEET B

CREST OF RISER ELEV. 1285.0

HEAD GATE SEE BELOW
FLOOR ELEV. 1274.0

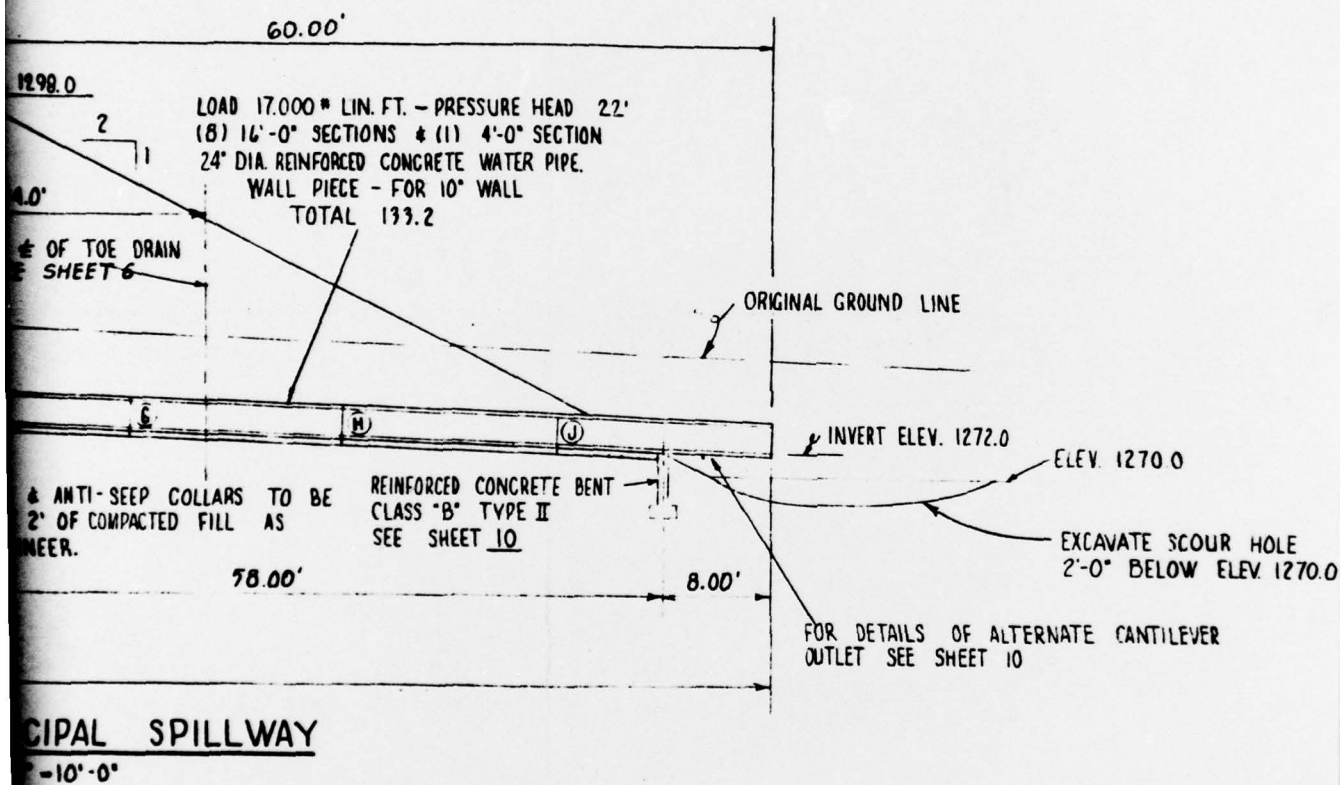
SEE DETAIL FOR RISER
* PIPE CONNECTION
SHEET B



PROFILE OF PRINCIPAL

SCALE 1"=10'

2



PROFILE OF DAM AND SPILLWAY
SUYDAM DAM

NAT. I.D. NO. PA.00085

WAYNE COUNTY

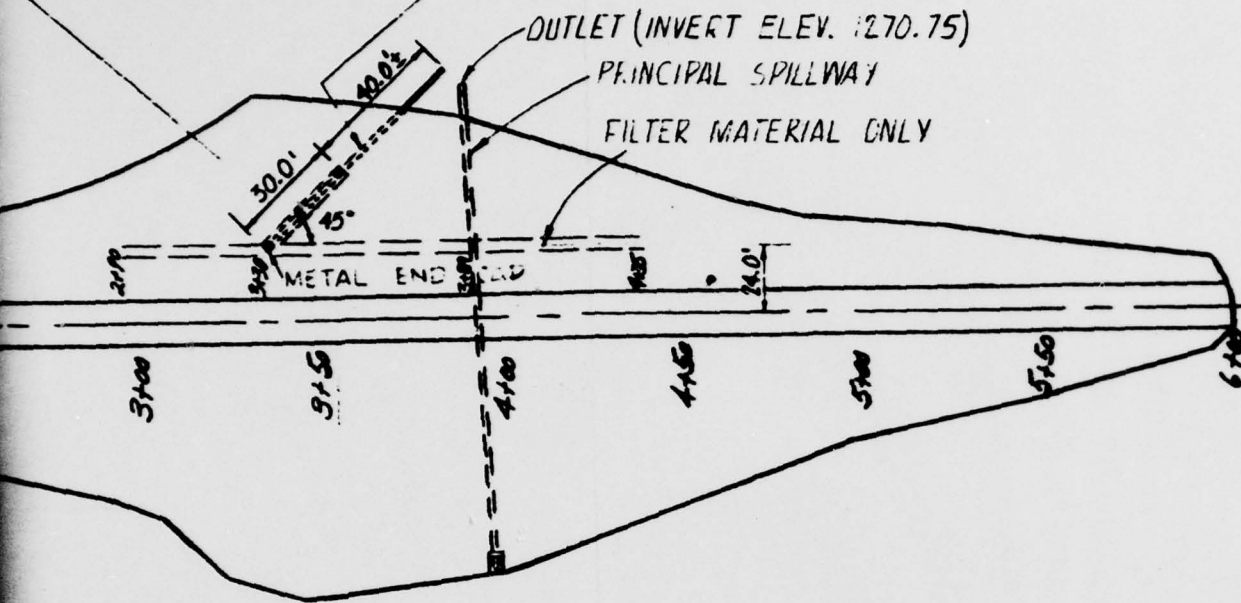
DATA OBTAINED FROM U.S. DEPT. OF AGRICULTURE, SOIL
CONSERVATION SERVICE, DRAWING NO. PA.-418-P, SHEET
NO. 7 OF 11, DATED 10/58

PLATE 3

IRAL
COUPLING BANDS.

40' OF 6" I.D. ANNULAR OR SPIRAL
B.T. CTD. C.M.P. WITH STD COUPLING BANDS
(NON-PERFORATED 16 GAUGE)

2



EW OF SEEPAGE DRAIN

IAL AND 7 OF 6" DIA
CTD. PERF. CMP. WITH STD
GE

OF 6 DIA ANNULAR OR SPIRAL
CTD CMP WITH STD COUPLING
B - 16 GAUGE - NON-PERF

INVERT ELEV 1270.75

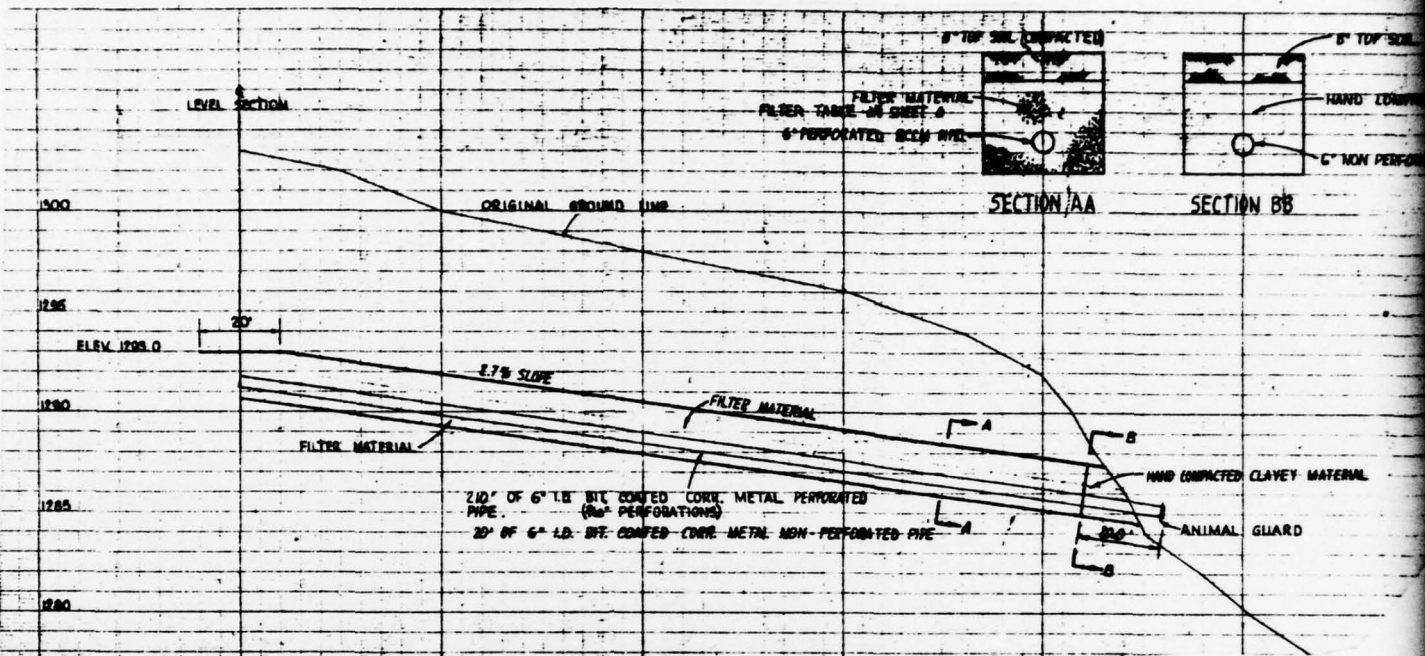
PROFILE OF SEEPAGE DRAIN SUYDAM DAM

NAT. I.D. NO. PA.00085

WAYNE COUNTY

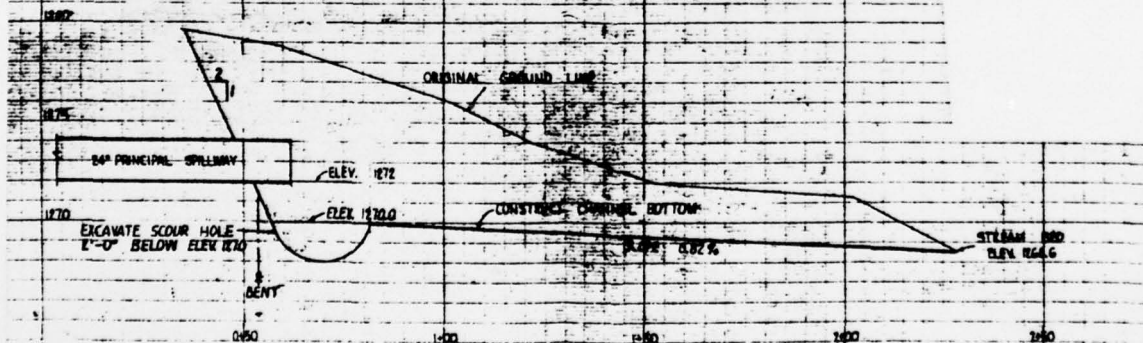
DATA OBTAINED FROM U.S. DEPT. OF AGRICULTURE, SOIL
CONSERVATION SERVICE, DRAWING NO. PA-418-P, SHEET
NO. 8 OF 11, DATED 10/58

PLATE 4



PROFILE ALONG C OF SPILLWAY DRAIN

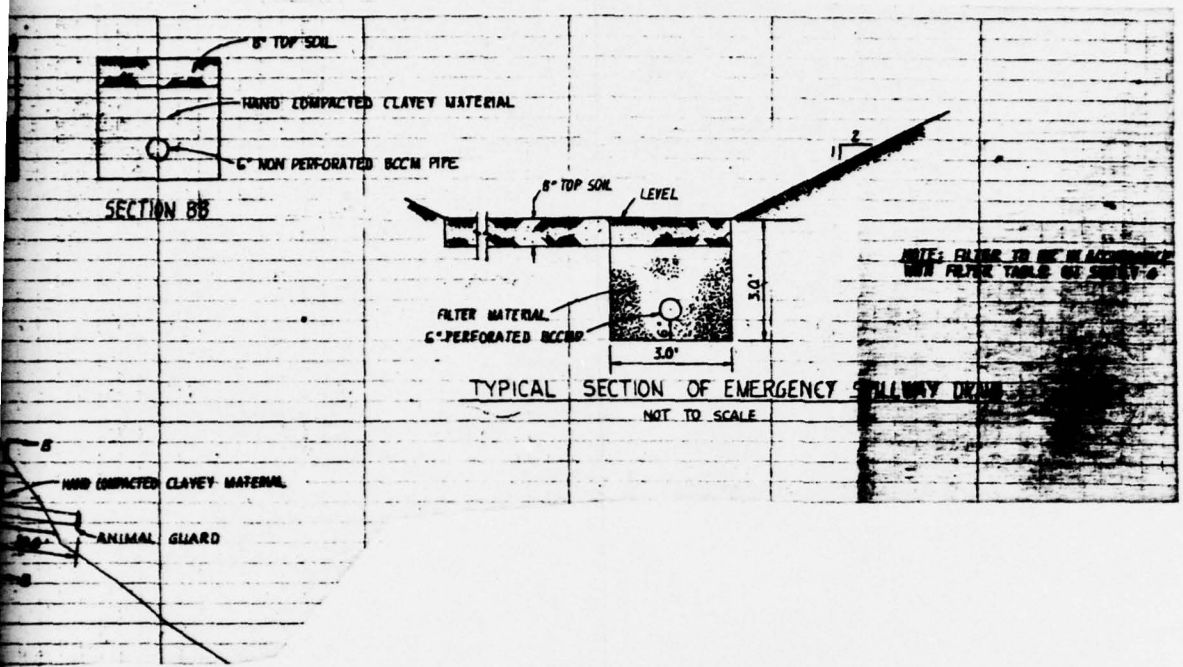
SCALE: HORIZ. 1" = 50'
VERT. 1" = 5'



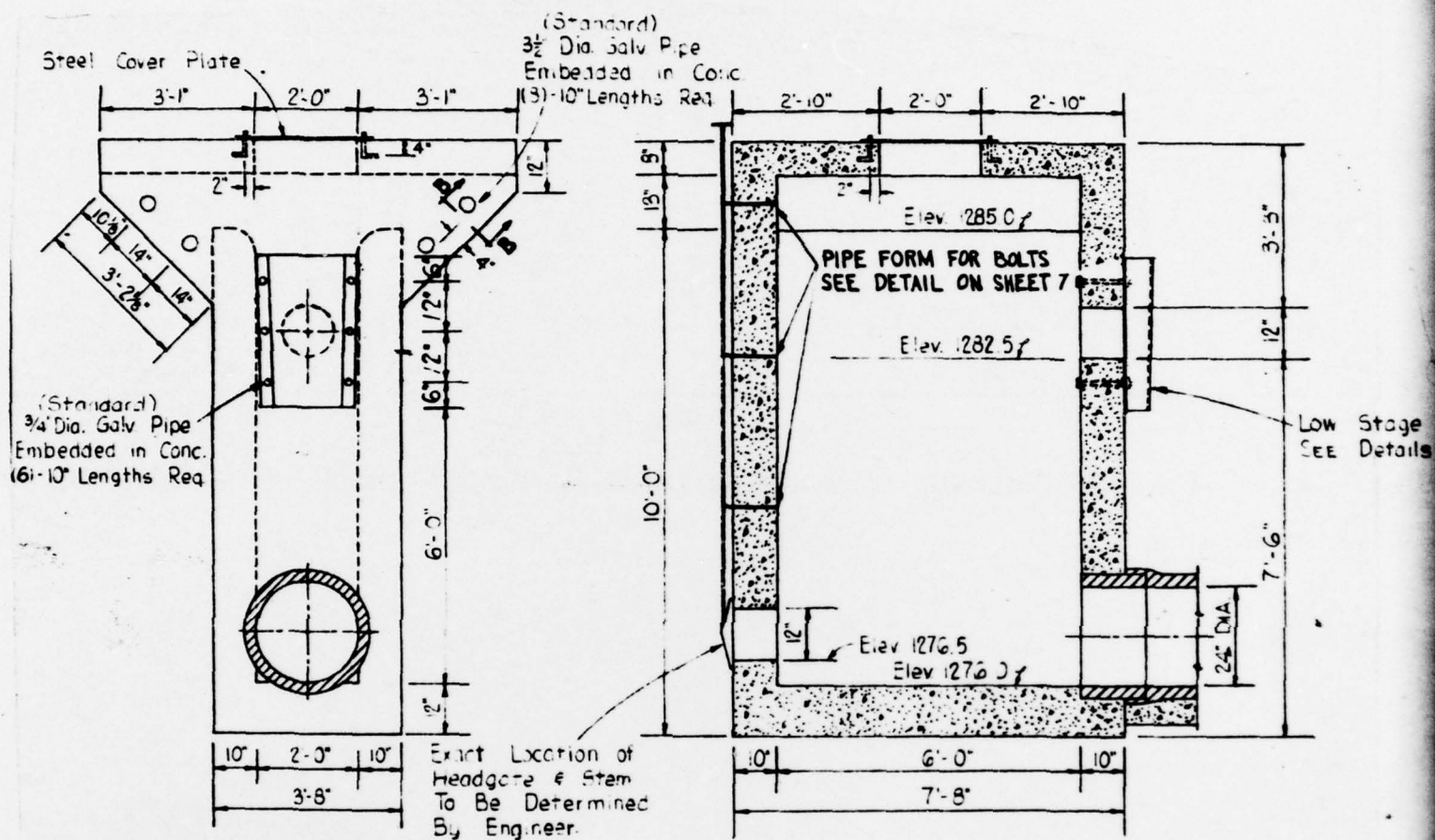
PROFILE ALONG C OF OUTLET CHANNEL

SCALE: HORIZ. 1" = 50'
VERT. 1" = 5'

2



<p align="center">PROFILE OF PRINCIPAL AND EMERGENCY SPILLWAYS SUYDAM DAM</p>	
<p>NAT. I.D. NO. PA.00085</p>	<p>WAYNE COUNTY</p>
<p>DATA OBTAINED FROM U.S. DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, DRAWING NO. PA -418-P, SHEET NO. 11 OF 11, DATED 10/58</p>	
<p align="right">PLATE 5</p>	



REAR ELEVATION

SECTION ON CENTERLINE

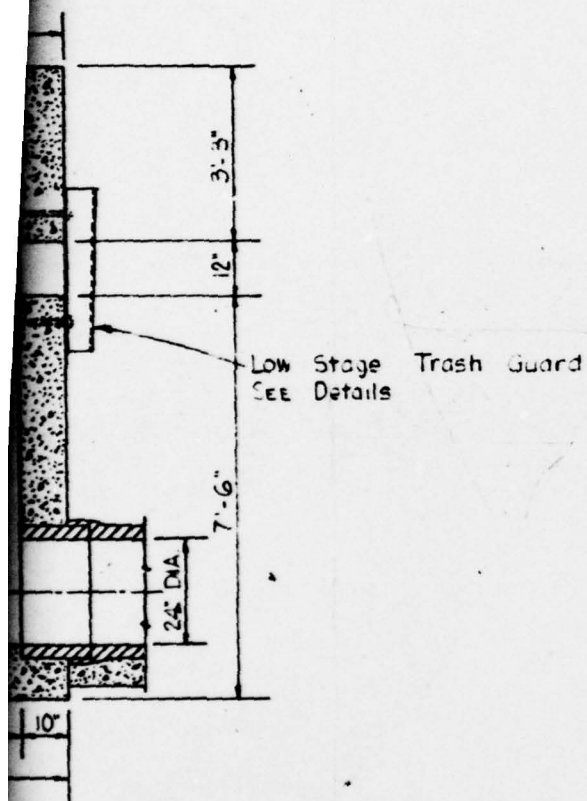
REINFORCED CONCRETE RISER

NOT TO SCALE

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CM
M

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**RISER DETAILS
SUYDAM DAM**

NAT. I.D. NO. PA.00085

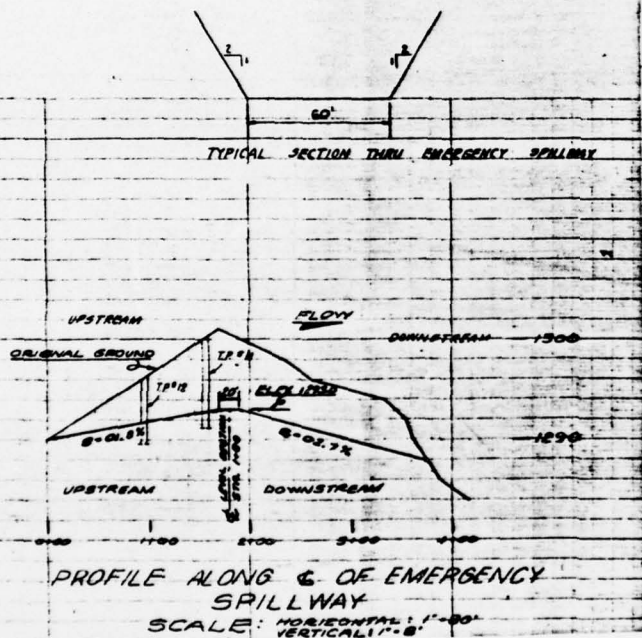
WAYNE COUNTY

**DATA OBTAINED FROM U.S. DEPT. OF AGRICULTURE, SOIL
CONSERVATION SERVICE, DRAWING NO.PA.-418-P, SHEET
NO. 8 OF 11, DATED 10/58**

PLATE 6

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 103 DEEP
 104 FINE SAND
 105
 106 FINE SAND
 107 VERY COMPACT
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 109 BILTY (CLAYEY)
 110 SAND
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 112 FINE SAND
 113 FINEST MOSS
 114 IN THE LONG
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LEGEND



DAM CENTERLINE PROFILE AND BORING LOGS SUYDAM DAM

NAT. I.D. NO. PA.00085

WAYNE COUNTY

DATA OBTAINED FROM U.S. DEPT. OF AGRICULTURE, SOIL
 CONSERVATION SERVICE, DRAWING NO. PA.-418-P, SHEET
 NO. 5 OF 11, DATED 10/58

PLATE 7

APPENDIX

F

SITE GEOLOGY

SUYDAM DAM

Suydam Dam is located in the Glaciated Low Plateaus Section of the Appalachian Plateaus Physiographic Province. As shown in Plate F-1, the dam site and surrounding region, as is much of northeastern Pennsylvania, is underlain by the Upper Devonian age Catskill Formation which in turn is overlain by a mantle of Wisconsin age glacial drift. No rock outcrops were observed during the field inspection, but rock types common to the Catskill include interbedded shale, siltstone, sandstone and conglomerate. Regional bedding strikes to the northeast, being diagonal to the dam axis. Rock jointing is characteristically steeply dipping to vertical. The spillway and dam are reportedly cut into glacial sand, clay and gravel. No downstream seepage was observed to indicate water flowing along the dam-glacial drift interface or the glacial drift-bedrock interface.

